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CONNAUGHT ANTITOXIN LABORATORIES
RESEARCH DIVISION

REPORTS

ON

PUBLIC HEALTH AND MEDICAL SUBJECTS.

No. 3.

THE PROGRESS AND DIFFUSION OF PLAGUE, CHOLERA AND YELLOW FEVER THROUGHOUT THE WORLD, 1914-1917.

MINISTRY OF HEALTH.

LONDON:
PUBLISHED BY HIS MAJESTY'S STATIONERY OFFICE.
1920.
Price 7*s*. 6*d*. *Net*.

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ON
PUBLIC HEALTH AND MEDICAL SUBJECTS.
No. 3.

THE PROGRESS AND DIFFUSION OF PLAGUE, CHOLERA AND YELLOW FEVER THROUGHOUT THE WORLD, 1914-1917.

By R. BRUCE LOW, C.B., M.D.,

with an Introduction by Sir George Newman, K.C.B., M.D., F.R.C.P.

MINISTRY OF HEALTH.

LONDON:
PUBLISHED BY HIS MAJESTY'S STATIONERY OFFICE.

1920.
Price 7s. 6d. Net.

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THE PROGRESS AND DIFFUSION OF PLAGUE, CHOLERA AND YELLOW FEVER THROUGHOUT THE WORLD.

CHIEF MEDICAL OFFICER'S INTRODUCTION.

To the Right Hon. CHRISTOPHER ADDISON, M.D., M.P.,
Minister of Health.

SIR,

1. This special report by Dr. Robert Bruce Low, C.B., deals with the progress and diffusion throughout the world of the three important diseases the control of which is a matter of international agreement. The period covered by the report is the first four years of the war. Before the war similar reports were issued annually by the Local Government Board, a procedure which was not practicable under war conditions. It can be predicted that the present report will prove as useful as was the long series of similar publications to many workers engaged in the prevention of disease, not as a statement on the pathology and bacteriology of these diseases but as an historical and geographical summary of their incidence and mortality during the years under review.*

2. Primarily for the protection of England, it has been, for the past 60 years or more, a duty of the Central Health Authority "to watch the incidence and spread of cholera and other dangerous epidemic diseases abroad." For about the same period it has been the practice to publish the results of this intelligence work in the Annual Reports of the Medical Department. When the Local Government Board became the Central Health Authority in 1871, the office arrangements in connection with this duty were organised to the extent that a special officer was instructed to keep continuous records of information received from abroad and to write an annual review. This arrangement, however, was not accompanied by a systematic organisation for obtaining a prompt and regular supply of information; reliance was placed rather on the gratuitous and casual receipt of such reports and news as reached the Board. This somewhat passive method of garnering information continued until 1908, when Dr. Theodore Thomson, realising that "our customary lack of prompt and full information is likely to impair the utility of the statements of cholera, &c., which the Board issues," proposed

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* In the current Annual Report of the Chief Medical Officer for 1919-20, further particulars will be found in the special appendix by Dr. R. J. Reece, C.B., on Ship-borne Plague. *See also* pages 202-212 of same Report.

that Consuls in Southern Russia, the Baltic and the North Sea as far west as Cherbourg, should be instructed to report, by telegram and weekly despatch, the occurrence of cholera in their districts. This method has now been extended and strengthened, with the result that the Ministry receive regularly a continuous supply of information from many parts of the world.

3. Moreover, an epitome of the more important epidemiological facts collated from numerous health reports, administration reports and the like, many of which are by no means easy of access for the isolated worker, is of great value to all engaged in the control or investigation of plague, cholera, and yellow fever. Owing to the circumstances of the war and the time and labour necessarily involved in the compilation of the facts and figures contained in this Report, it deals only with the four years, 1914–1917.

4. Apart from the direct value of such a *resumé* of facts as Dr. Bruce Low has furnished for the last 23 years to workers in the field of public health, these reports serve another purpose. The progress made in the public health during the last half century makes it unlikely that plague, cholera and yellow fever will be a serious menace to the health of the inhabitants of these islands. Bubonic plague on a large scale is improbable because the people of the United Kingdom do not live in that intimate association with rats on which extensive prevalence of this disease depends; cholera, because most, if not all, of our large centres of population are provided with a water supply adequately guarded against gross contamination; yellow fever, because the particular mosquito that can alone convey infection does not naturally exist in temperate climates. But plague and cholera are still the cause of an enormous loss of valuable lives in our dominions overseas and are responsible for much misery and suffering. Yellow fever remains a menace against which many of our tropical and subtropical possessions have to be constantly on guard. If Great Britain is to be in a position to meet its imperial obligations in regard to the Public Health, the prosecution of research into the many outstanding problems connected with tropical disease and the diffusion of knowledge regarding them are matters of the first importance.

5. Though Dr. Bruce Low's report deals only with Plague, Cholera, and Yellow Fever, it must not be forgotten that these three scourges are not the only diseases calling for grave consideration. Malaria, for example, is probably responsible for more invalidism, inefficiency and sickness than all other causes of tropical morbidity put together. Then the dysenteries, diarrhœas, fevers of the typhoid group, smallpox and other exanthemata, typhus and relapsing fevers, such debilitating conditions as those produced by hookworm infestation, tuberculosis in its various forms, leprosy, venereal diseases, and many others, all present problems of paramount importance that

daily call for the careful consideration which they receive in various parts of the British Empire. An annual record of the progress and diffusion of all these conditions, interesting and informing as it might well be, would be a task of such huge proportions as to make its undertaking impracticable.

6. Nevertheless, the more accurate compilation and registration of vital and mortal statistics is preliminary to all public health effort if it is to be free from misdirection. We require fuller knowledge of (*a*) the population and its movements; (*b*) the general death rate; (*c*) the correct medical certification of the cause of death; (*d*) the age and sex distribution at death; (*e*) the seasonal incidence; and (*f*) the relation of zymotic death returns to each other, and to the total death rate. In perhaps no country of the world are such records kept with the accuracy that the effective practice of preventive medicine actually requires. In many of the countries in which plague, cholera, and yellow fever are most widely prevalent, the causes of death have but a partial claim to scientific accuracy. In all but the larger towns of most of our tropical and sub-tropical dominions the actual registration of death is in the hands of persons without medical qualification; frequently, indeed, they can barely claim to be "literate." Only a small percentage of the people who die are seen in their last illness by qualified medical men or women. This fact, taken in conjunction with the registration imperfections, necessitates the utmost caution in drawing deductions. The resulting statistics are, however, by no means worthless, though they generally demand intimate local knowledge for their correct interpretation, as also considerable knowledge of the epidemiology of tropical diseases. The total number of deaths recorded is in a considerable number of cases a close approximation to the truth; and, generally speaking, the same may be said as to the locality and sex of the deceased, the approximate age at death, and the date and season of death. In investigating the havoc caused by any of the chief epidemic diseases in tropical countries such data are of essential value. Most of the more important epidemic diseases—notably plague, cholera, yellow fever, and malaria—have each a well-defined, fairly constant, and characteristic seasonal prevalence in any given area. The age and sex incidence of different diseases varies likewise in a distinctive manner. If, therefore, we possess knowledge of the age, sex, and local distribution of the population under consideration, and of the relation of mortality thereto, we may hope to arrive at deductions of considerable practical importance. Without such local knowledge, however, there is some danger of arriving at erroneous conclusions. An example may be named from the present report. It will be seen that the number of males that die annually from plague in Bombay City are constantly in large excess of the number of female deaths ascribed to plague. Were one ignorant of the fact that the male portion of the population in Bombay City is numerically in excess of the female population, in similar

proportion, one might be inclined to deduce erroneously that plague was much more common among, and fatal to, men than women. Or again, most of the tables in this Report record total deaths only from plague, cholera, or yellow fever. Such a return without the comparable figures of population of the affected areas, and the total deaths from all causes, are liable to be misleading. These are matters of elementary importance, but they are frequently overlooked. The necessity of sufficient local knowledge as a preliminary to the elucidation of facts based on statistical data can hardly be over-emphasised. All these matters make it essential to recognise the inherent limitations of a report of this nature. But of its value as furnishing a general picture of the vast movements of diseases which alter the course of human history there can be no doubt. These facts are to be had in mind in appraising the results. They do not diminish the gratitude due to Dr. Bruce Low, whose assiduous and long continued labours have enabled the Local Government Board and the Ministry of Health to place in the hands of epidemiologists better documented summaries of the available facts than can be found in private monographs. This is a considerable achievement, and the facts here recorded are deserving of close attention.

7. Of the three formidable epidemic diseases reviewed, one, although never acclimatised within the United Kingdom, has through generations caused a vast mortality amongst subjects of the British Empire; another within the memory of some still living, has destroyed thousands of lives in this country; the third, if to us here no more than a memory, is yet of dreadful memory, and was one of the great facts which moulded the course of our economic and social history. In addition to recording (*a*) their progress and diffusion these reports serve to register year after year (*b*) some additions to our knowledge of the nature of these diseases, and (*c*) the means of their propagation and prevention. Looking back to the time when these reports first appeared, we realise how little was then known of the essential facts concerning them. To-day our information regarding the nature and the epidemiology of bubonic plague is relatively great, though even yet there remain unknown factors in its epidemiology. But we know sufficient to realise that the ravages of this disease might be substantially reduced given the whole-hearted co-operation of the affected populations. As regards yellow fever this century has witnessed the skilful and heroic work of the American Commission, which demonstrated conclusively that the disease was transmitted by the *Stegomyia* mosquito and in no other way, and on that fact based their remarkable work in the Panama Canal zone; and as recently as last year Noguchi published his reports regarding the nature of the causative organism. With regard to cholera, though the causal spirillum was discovered by Koch as long ago as the early eighties of last century, recent years have witnessed many important additions to our knowledge of the epidemiology of the

disease, and have seen the introduction on a large scale of a preventive vaccine, the use of which is claimed to have been of value in the control of certain outbreaks during the course of the recent war.

Plague.

8. The appearance of epidemic plague in Bombay in 1896 and its subsequent extension over so large a part of the Indian Peninsula acted as a stimulus to research, with the result that fuller and more detailed knowledge regarding the "natural history" of the bubonic form of disease is now available, particularly from the work done by the medical services in India. Epidemiological studies have likewise placed us in possession of some valuable information regarding the social and physical conditions which, given the presence of infection, determine the persistence of bubonic plague in epidemic form. The scientific facts now at our disposal enable us to design preventive measures on a much surer and wider basis than was possible in the closing years of the last century. There are still, however, problems connected with plague that require elucidation, foremost perhaps being the causes determining the appearance of epidemic plague, sometimes in the primary pneumonic form, sometimes in the septicæmic form, and, most commonly in India, in the bubonic form. All these types of the disease are caused by the invasion of the body by the *bacillus pestis,* first isolated by Yersin in 1894. Epidemiologically and from the public health standpoint bubonic plague and pneumonic plague present themselves in practice as almost distinctive diseases, though one form may follow the other and both may become septicæmic. Pneumonic plague is directly contagious from man to man. Bubonic plague is essentially a disease of rats to the secondary infection of which man and a few of the lower animals are liable.

9. A clear recognition of the fact that bubonic plague is dependent for its prevalence upon epizootic plague in rats is of fundamental importance. The vehicle of contagion between rat and rat or between rat and man is the rat flea infected with the bacillus; the vitality of the plague bacillus outside the bodies of man, rats or fleas is of comparatively short duration and its virulence is mutable and may be reduced (there is evidence indeed of the occurrence of some degree of immunity in rats); and the disease is not, except in pneumonic form, highly infectious from man to man. It follows, therefore, that bubonic plague in severe epidemic form is only possible in communities in which man lives in close association with the rat. Such conditions are not usually found in Western Europe, for example, where the *Mus rattus*, the black house-rat, the most "domesticated" species of rat, is much less common than it used to be. The persistence of bubonic plague in severe epidemic form is dependent

upon, and in direct relation to, the infestation of the dwelling houses with rats and the infestation of the rats with fleas. Conditions favouring a high degree of flea infestation of rats are largely climatic and, consequently, beyond human control : preventive measures, therefore, designed to break the close association between the rat and the human population offer most chance of success. The immunization of the individual by inoculation with plague vaccine is of value, but this measure does nothing towards the *eradication* of bubonic plague, which is essentially a rat disease.

10. Yet with these groups of facts before us we have not all the data we require. Some undetected factors or set of circumstances still elude our grasp; we still do not fully understand a disease which has a fairly definite geographical distribution, which dies out apparently "spontaneously" in some endemic areas, and which does not affect millions of people living in the tropics or sub-tropics under conditions apparently identical with those obtaining in affected districts. A recent Resolution of the Government of India, Education Department, No. 637, dated 18th August 1920, summarises the plague preventive measures that offer most chance of success in the fight against plague. The Resolution provides further evidence of the fact that the Government of India fully recognise their responsibilities with regard to this matter as well as the difficulties of the problem that confronts them.

11. The methods of Preventive Medicine which have been and should be adopted seem to be clear; though it is obvious that in different areas and at different times the relative importance of the several measures varies :—

(1) Provision of hospitals for the treatment of the sick.

(2) The evacuation of infected houses or areas.

(3) The inoculation of the community with anti-plague vaccine, which in spite of native suspicion and even unpopularity is steadily increasing in some affected districts.

(4) Systematic destruction of rats and the avoidance of conditions, in merchandise or otherwise, which provide them with food and shelter.*

(5) Erection of rat-proof grain stores.

(6) A more rigorous port sanitary control.

(7) Steady advance of sanitation, housing, and the practice of quarantine.

(8) Education of the people in order to overcome as far as may be natural inertia and prejudice in regard to the importance of active measures of protection.

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* The Government of India Resolution emphasises the importance of grain and the grain trade as factors in the persistence and dissemination of plague infection.

12. Of these measures the first three are palliative only; they do not primarily strike at the root of the trouble; they are merely defensive tactics. Good housing and sanitation are among the surest means of extirpating plague, for they deprive rats of food and shelter. Direct rat destruction is also a valuable factor in an anti-plague campaign; though the attendant difficulties of direct, well-organised and continuous rat destruction are considerable. It is expensive; certain Indian communities are averse from the destruction of rats; and adequate means of destruction have yet to be devised. It has been known for some years that the storage of grain in rat-infested buildings and the uncontrolled transit of grain from and through plague infected districts offer unique facilities for the spread of plague. The incidence of the disease in the different areas of the United Provinces and the imports of grain into those areas appear to be related, and attention given to these matters would seem to promise a considerable diminution in the extent of the disease with a minimum amount of interference with the liberty of the individual. Plague is not uniformly prevalent over the whole of India. Speaking broadly, plague-infected India is wheat-growing India; whereas the large rice-growing areas are for the most part relatively free from plague. The explanation has been advanced that rice-growing India is rice-eating India, and the imports of grain for home consumption are relatively insignificant. The wheat-growing areas are grain exporting areas and considerable quantities of the cheaper grain were in consequence formerly imported for the food of the population. These extensive movements of grain offered facilities for the importation of plague infection that were non-existent in the rice-growing provinces.

13. The variation in intensity of epidemic plague in the various administrations of India have been very marked. Between 1898 and 1918 mortality in the Punjab amounted to 122·27 per 1,000 of the population; in Bombay, 87·35; and in the United Provinces, 49·45. On the other hand, the plague mortality in the same period in Bengal was only 1·49 per 1,000; Madras, 3·45; and Burma, 8·03. Three-quarters of the total plague mortality has occurred in the Punjab, Bombay and the United Provinces, the combined population of which is less than one-third of the population of British India. Since plague became epidemic in India in 1896 more than 10 million deaths have been ascribed to the disease. There has been a remarkable variation in the severity of the annual outbreaks. The four most severe outbreaks as measured from July to June ("the plague year") in each case were experienced in 1904–05 (1,328,249 deaths), 1906–07 (1,286,513), 1903–04 (1,138,451), and 1917–18 (820,292). These four years alone witnessed more than four and a half million plague deaths. Certain epidemics have been relatively mild: thus, the outbreak of 1908–09 was responsible for only 126,442 deaths. The extreme fluctuations

of mortality in an occupied district have not yet been explained. In British India as a whole the total mortality from plague in the last 22 years has not greatly exceeded that due to cholera, but the latter disease has varied much less from year to year. Another contrasting feature is that the districts most subject to plague have been least ravaged by cholera, thus of four great territories, the Punjab ranked first in plague mortality with nearly 3 million deaths, followed by Bombay with 2¼ millions, the United Provinces with nearly as many and then, at a great interval, the Madras Presidency with less than 150,000. The order in the matter of cholera mortality is precisely reversed. In the same period, Madras had a million and a third deaths, the United Provinces a million and a quarter, Bombay 590,000 and the Punjab just over 100,000. The startling variations of mortality are impressive in the Punjab, where, following 244,104 in 1915, only 4,151 were recorded in 1916, and in 1917 the quota although larger (9,724) was less than in any previous year but 1916. It was naturally supposed that preventive measures were at length bearing fruit, but the first half of 1918 contributed more than 94,000 to the roll of deaths. Both the ætiology of successful implantation and of violent fluctuation remain without explanation, just as the apparent extinction of plague in our own country remains inexplicable. For many years a restricted area of epizootic plague in this country (*see* page 146) has been under observation. Since 1910, when, the facts were recognised seven cases of human plague have occurred there, two as recently as June 1918 (both fatal). The vigour of the preventive measures taken sufficiently accounts for the non-development of an epidemic upon the grand scale; it does not explain why no epidemic at all occurred.

14. With such marked annual variation in intensity it is difficult to arrive at definite conclusions regarding the diminution or increase in the prevalence of the disease. The year 1917–18 was one of the worst in the decennium, and notwithstanding the great decline in the latter half of 1918 (within which period an appalling outbreak of influenza destroyed some millions) and the extremely small quota of the first six months of 1919—only 53,027—it is to be feared that the administrative solution of the problem, the effective control of the disease, is far from having been achieved. Much is attributed, and no doubt justly attributed, to the ignorance and inertia of the inhabitants, to the passive and sometimes active opposition with which such measures as the destruction of rats are encountered. Had it not been for the very severe outbreak of plague in 1917–18 in India there would have been good grounds for considering the pandemic to be on the wane. In this connection it is worthy of note that 1917 was a year with the highest rainfall on record. Excessive rain postulates humidity much in excess of the normal and it has been established that excessive humidity, within a certain range of temperature, favours an excessive prevalence

of fleas.* On the whole, however, there does appear to have been some decline in the severity of the pandemic.† The diminished severity is associated with, possibly determined by, an increasing immunity of the rat population to plague in the worst affected tracts of India. But until the problems referred to have been solved, it would be premature to regard plague as a disease which does not directly menace the inhabitants of Europe; it would be unwise to suggest that our knowledge of the disease and its control as a whole is sufficiently complete to permit a belief that the disease will speedily be reduced to a position of comparative impotence.

Cholera.

15. The records of the prevention of cholera and yellow fever are in some ways more encouraging than that of plague. Cholera has declined in the presidencies of Bengal, Madras and Bombay. In Bombay, in 1915, it fell lower than at any time since 1892. In Bihar and Orissa there was a substantial and steady increase throughout the four years, and a serious epidemic occurred in the Punjab in 1915 and in the following year in the Central Provinces. In Burma, also, cholera was widespread in 1915, and then fell lower than it had been for 20 years. The outbreak which had been anticipated in the Near East and in Europe during the war (1914–18) did not occur except in Turkey, the Balkans, and certain local districts.

16. Between 1892 and 1896, Dr. F. W. Barry wrote his well-known reports to the Local Government Board on the origin and progress of the Western diffusion of cholera. He concluded

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* *See also* "Twenty Years of Plague in India," by Major Norman White, C.I.E., M.D. (Thacker, Spink & Co., Calcutta).

† In the words of the Government of India Resolution, already referred to, it is stated that—

> "Owing to the character of the seasons, to the gradual conferment of partial immunity from the disease upon the rat population of certain centres, and possibly to a change in the virulence of the causative organism, there has recently been evidence indicating a decline in the epidemicity of plague. In 1918–19 the mortality sank to less than one-sixth of the mean mortality from this disease during the past 20 years. In the year now current, though there are indications that the disease is again increasing, the mortality up to and including January was far below the average. Plague constitutes a notable example of seasonal disease, its intensity being at the lowest ebb in July, gradually increasing till it reaches its zenith in March, and rapidly declining during the next four months. It is axiomatic that in every epidemic disease with marked seasonal prevalence, the first and most obvious line of attack lies in reducing the number of foci of infection during the period of minimum intensity—*i.e.*, during the non-epidemic season. The opportunity thus annually offered for the extermination of bubonic plague is rendered all the more favourable now by the fact that the disease appears to be passing through a period of low epidemicity."

that such diffusion invariably followed lines of human intercourse, increased facilities for intercommunication being followed by rapid spread of the disease; that cholera thus spread by river traffic attacked more centres of population than when diffused by land communication; and that "explosions" of cholera are referable to specifically polluted water supplies. Further experience has tended to confirm those findings, though it is now known that the vehicle of infection may also be human "carriers" and flies. This is, no doubt, in part the explanation of the close association obtaining between pilgrimages, fairs, &c., and the diffusion of cholera. It is reasonable to assume that much of the decline of cholera has been due to improved water supplies, and a better knowledge on the part of the public of the accepted preventive measures in regard to cleanliness of body, clothing and food. Considerable care, also, is taken to minimise the risks of infection entailed in pilgrimages to Mecca and other holy places—medical inspection and quarantine, preparation of accommodation, provision of protected water supplies, adequate latrines, shelters and lodging places, and control of food supply. But the apparently healthy "cholera-carrier" remains a problem.

17. From Dr. Bruce Low's report, it will be seen that, in the 22 years ending in 1917, cholera caused more than eight and a quarter millions of deaths in British India alone, but left the inhabitants of Western Europe almost untouched. Without deciding upon the respective shares of human carriers, flies and gross contamination of drinking water in the epidemiology of the disease, the evidence is convincing that no country in the enjoyment of adequately safeguarded water supplies and paying proper attention to the disposal of excreta incurs much risk of epidemic cholera. These considerations mitigate our apprehensions, but they do not diminish the gravity of a problem the solution of which is of imperial concern.

Yellow Fever.

18. Yellow fever is an acute, specific, febrile disease, subject to considerable clinical variation, but having as its usual signs "black vomit," albuminuria, and jaundice. An attack generally confers immunity, but the fatality is high. Natives of yellow fever districts are practically immune. The germ is transmitted by the mosquito, *stegomyia fasciata* (sometimes known as *s. calopus*). The disease has a limited distribution and is confined mostly to two main regions, part of South and Central America and part of the West Coast of Africa. Formerly, the West Indies was also an endemic area.

19. During 1914 the Panama Ship Canal was opened for traffic, an event which for years before had been feared by some authorities on the ground that this new waterway, passing through

an endemic area and connecting stegomyia-infested ports, might facilitate the spread of yellow fever. Happily, this has, so far, not been the case; indeed, the control of mosquito-borne disease in the Panama is one of the triumphs of modern medicine. It was in 1904 that the late Surgeon-General Gorgas, whose recent death is a loss to the science and art of Preventive Medicine throughout the world, established his system of sanitary control in the Panama. He had to deal with malaria and yellow fever, and he was successful in substantially reducing both by the establishment of a system of control. (1) First, health departments were established in the cities of Panama at the Pacific end and Colon at the Caribbean end of the Canal, health officers placed in charge, and the district sub-divided into sanitary areas; (2) general sanitation was advanced, water-supplies, sewerage, paving, &c.; (3) then each unacclimatised non-native person was placed under daily supervision; (4) the breeding of mosquitoes was, by ordinance, made a prosecutable nuisance; (5) drainage of all collections of water followed and, where this proved impracticable, paraffin oil was spread upon the water; (6) mosquitoes in houses and other buildings were killed by gangs of inspectors working with chloroform test-tubes; (7) lastly, a prophylactic 3-grain dose of quinine was furnished *gratis* by means of 30 dispensaries, and if and when a person sickened with malaria he was isolated. Gorgas reported that "this mosquito work cleared the zone of yellow fever. In May, 1906, we had our last case. It has also brought malaria down to such proportions that it does not interfere with the construction work. . . . All that has been done at Panama is to protect from the infectious diseases, principally malaria and yellow fever. This is evidence that *it is the infectious, not the climatic, conditions* that have heretofore caused the wilting away of the white man in the tropics. . . . I believe that we are on the eve of the occupation of the tropics by the white man."

20. Another important event is the discovery claimed by Noguchi, a Japanese investigator of the Rockefeller Commission on Yellow Fever, of the cause of the disease. For some years it was believed that the disease was due to a protozoon parasite having a cycle of development partly in the mosquito and partly in man. In 1919 Noguchi was able to cultivate from the blood of patients a spiral organism to which he gave the name of *Leptospira icteroides*. This parasite he has traced in human blood, and by it has been able to transfer infection from one animal to another by means of the stegomyia mosquito.

21. Dr. Bruce Low's survey draws attention to the fact that the disease is declining. The opinion he expresses that there are "reasonable grounds for thinking that yellow fever may now be included in the list of diseases that are disappearing from the earth as a result of medical science and the advance of

civilisation," will commend itself to all who study his report. He attributes the decline (*a*) to the favouring influence of the war which has reduced the number of "non-immunes" entering the endemic districts of the world, (*b*) the eradication of the disease in the chief disseminating ports, notably Havana, Rio, and Panama, and (*c*) to the substitution of steamships for old sailing vessels. Ship epidemics were relatively common occurrences formerly, and by means of ill-ventilated sailing vessels the water supply of which was stored in barrels accessible to *stegomyiae*, the infection was believed to be conveyed. The concurrent testimonies as to the reduction of yellow fever in Panama, and the data summarised on pages 252–3 of this Report, are so strong and unanimous that we can hardly doubt that with an active and properly informed public health system, enjoying popular support and approval, it is possible to root out endemic centres of yellow fever. A comparison of Havana and Rio de Janeiro on the one hand, with Guayaquil on the other. is eloquent.

Before the introduction of scientific prophylaxis in 1901 Havana never recorded fewer than 100 deaths in the years back to 1873. and eight times had more than 1,000. From 1901 to 1917 the gross record is of but 58 deaths. In only one year of this series has the much smaller and untreated port of Guayaquil returned as few deaths as have occurred in Havana in 17 years. It is, therefore, broadly true that, at least potentially, and in some countries and circumstances actually, a community is able to eliminate yellow fever and prevent its importation.

Conclusion.

22. The extension of civilisation in the tropics, and Britain's responsibilities in the East make the subject of the control of these exotic diseases, which year by year bring suffering and death to vast numbers of people, a matter of vital importance. The needs of the case demand at the centre improved organisation, international as well as national, and greater vigilance, and locally fuller and more accurate returns and a closer application of the means of prevention. The series of reports, which for a generation have been prepared by Dr. Bruce Low, confirm and emphasise these requirements.

Several years ago the Local Government Board instituted a weekly notification to port sanitary authorities in this country of the known prevalence of plague, cholera, and yellow fever in foreign ports; and the scope of these weekly reports has been extended by the Ministry of Health to other diseases, and to notification to Colonial, Dominion and other British representatives abroad. Other collateral arrangements for the protection of this country and the control of these diseases have also been devised, and important international agreements have been concluded and executed for these purposes; these, however, are not matters to be discussed here. But one thing may be said; the experience of man's conflict with disease on a world scale, and over centuries of time, has taught him that there is a general method, and there is a particular method of prevention. The general method includes attention to the universal needs of a healthy life for all men—food, clothing, water-supply, cleanliness, housing, land drainage, sanitation and public education in hygiene, each in its broadest meaning. The particular method is concerned with the application of the specific or technical means necessary to deal with the particular channel or circumstance which conveys the infection—food, water, "carrier" and "contact" in cholera; rats in plague; mosquitoes in malaria and yellow fever—or which counteracts the virus by inoculation, by vaccine, by anti-toxin or by disinfectant. He only is the wise physician who uses both—first the former method, then the latter. The preventer of famine, the bestower of cheap bread, the irrigator, the land drainer, the true social reformer, the educator—these are the pioneers who, by making the ordinary and daily life of man a better and more wholesome thing, lay the foundations upon which the sanitarian and physician can build. This seems to be the principal lesson of this series of reports, and of all means of prevention the spread of knowledge and education is the supreme. There must be continuous and well applied research into the conditions which favour the origin and incidence of all tropical diseases, for their prevalance is a matter of the gravest concern to Great Britain and her dominions. There must be education of the medical students and practitioners throughout the Empire in the natural history, pathology and treatment of these diseases, and there must be education of the people as a whole in the applications of science to their prevention.

I have the honour to be,
Sir,
Your obedient Servant,
GEORGE NEWMAN.

Ministry of Health,
Whitehall,
October, 1920.

I.—THE PROGRESS AND DIFFUSION

OF

PLAGUE,

throughout the WORLD during 1914, 1915, 1916 and 1917.

CONTENTS.

I.—PLAGUE.

PAGE

A.

Aden - - - - - - 149
Alexandria - - - - - 132
Algeria - - - - - - 114
Amoy - - - - - - 86
Argentine - - - - - 105
Assam - - - - - - 72
Astrachan - - - - - 147
Austria-Hungary - - - 147
Azores - - - - - - 113

B.

Bahia - - - - - - 109
Bahrein Islands - - - 149
Baluchistan - - - - - 66
Basra - - - - - - 148
Beirut - - - - - - 148
Bengal - - - - - - 28
Bihar and Orissa - - - 33
Bombay Presidency - - 14
Bombay City - - - - 18
Brazil - - - - - - 108
Bristol - - - - - - 143
British East Africa - - 128
Burma - - - - - - 49

C.

Cairo - - - - - - 132
Calcutta - - - - - 29
California - - - - - 95
Canton - - - - - - 85
Cape Colony - - - - 119
Central Provinces and Berar - 54
Central India Agency - - 69
Ceylon - - - - - - 73
Chili - - - - - - 104
China - - - - - - 83
Chios - - - - - - 148
Colombia - - - - - 99
Colombo - - - - - 73
Coorg - - - - - - 72
Cuba - - - - - - 112

D.

Dakar - - - - - - 116
Dar-es-Salaam - - - 128
Delhi - - - - - - 48
Dutch East Indies - - - 76

PAGE

E.

East Africa - - - - - 128
East Suffolk - - - - 146
Ecuador - - - - - 100
Egypt - - - - - - 130
England and Wales - - 136

F.

Foochow - - - - - 87
Formosa - - - - - 91
French West Africa - - 116

G.

German East Africa - - 128
Gibraltar - - - - - 136
Gold Coast - - - - - 118
Greece - - - - - - 133
Guayaquil - - - - - 100

H.

Hawaiian Islands - - - 94
Holland - - - - - 146
Hong Kong - - - - - 83
Hull - - - - - - 145
Hyderabad State - - - 61

I.

India - - - - - - 6
Indo-China - - - - - 80
Italy - - - - - - 134

J.

Japan - - - - - 91

K.

Kashmir - - - - - 67
Karachi - - - 23

L.

London Port - - - - 136
Liverpool - - - - - 140

PAGE

M.

Madras Presidency - - 24
Madras City - - - - - 24
Malta - - - - - 135
Manchuria - - - - - 90
Mauritius - - - - - 123
Mesopotamia - - - - 148
Morocco - - - - - 115
Mysore - - - - - - 60

N.

New Caledonia - - - 94
New Orleans - - - - 97
Northern Rhodesia - - 121
North-West Frontier Province 58
Nyasaland - - - - - 129

O.

Oman - - - - - - 150
Orange Free State - - 120

P.

Pakhoi - - - - - - 85
Paraguay - - - - - 108
Penang - - - - - 76
Pernambuco - - - - 110
Persia - - - - - - 150
Peru - - - - - - 102
Philippine Islands - - - 93
Port Alegre - - - - 111
Port Elizabeth - - - 120
Port Louis - - - - - 126
Portugal - - - - - 135
Portuguese India - - - 73
Punjab - - - - - - 42

PAGE

R.

Rajputana and Ajmer-Merwara 63
Rangoon - - - - - 50
Réunion - - - - - 122
Rhodesia - - - - - 121
Rio de Janeiro - - - 109
Russia - - - - - - 147

S.

Seattle - - - - - - 97
Senegal - - - - - 116
Shanghai - - - - - 87
Siam - - - - - - 79
Sicily - - - - - - 134
Singapore - - - - - 76
South Africa - - - - 119
Spain - - - - - - 136
Straits Settlements - - 76
Swatow - - - - - 86

T.

Transvaal - - - - - 121
Tripolitania - - - - 115
Turkey - - - - - - 148

U.

Uganda - - - - - 129
Union of South Africa - - 119
United Provinces of Agra and Oudh - - - - 37
United States - - - - 95
Uruguay - - - - - 107

V.

Venezuela - - - - - 111

Z.

Zanzibar - - - - - 127

INTRODUCTORY.

It is perhaps scarcely necessary to point out at the present day that one of the chief objects in preparing year by year these summaries of the progress and diffusion of plague throughout the world, is to place on permanent record in an accessible form facts and figures concerning this disease (as also for cholera and yellow fever) collected from official and other trustworthy sources, so that those in future years seeking information on the subject may have available the data compiled systematically on a uniform plan over a long series of years. Comparison can, in this way, be made of the behaviour of the disease in the past and present, and material supplied for future study of the malady, its epidemiology, etiology and prevention. The records relating to plague (and cholera) have been maintained by the Medical Department of the Local Government Board ever since the constitution of the Board as the Central Health Authority for England and Wales. As far as can be ascertained, no other Central Health Authority in Europe or elsewhere has, so far, undertaken the compilation of a similar record for so prolonged a period.

As it has been the duty of the present writer to prepare for publication these annual summaries since 1896, *i.e.*, for a period of 23 years, and as this is in all probability his last contribution to the series, he may be permitted to express the hope that they will not be discontinued by the Ministry of Health, which has now taken over the functions of the defunct Local Government Board.

That these reports on plague, cholera and yellow fever have been of service is proved by the numerous letters and communications received from different parts of the world, expressing appreciation of the information imparted, and also of the assistance afforded by these reports to those whose duty it is to control these three chief exotic diseases.

It has already been pointed out in previous reports that the present pandemic of plague began more than 25 years ago, and that it apparently emerged from the interior of China, reaching the southern coast of that country about 1893. The infection was carried by shipping mainly from East to West until, eventually, it involved almost every part of the known world. The disease has shown a greater tendency to settle in some countries as compared with others, and under favouring circumstances it has become endemic in them. This endemicity is apparently maintained through the agency of various kinds of animals, of which rats are the chief; but the tarbagan-marmot, the spermophile, the ground-squirrel, as well as some other smaller species of rodentia, play their part in one country or another in fostering the endemicity of plague. Most of the civilised nations of the world are carrying out a campaign of extermination of rats; but in some countries, especially those that are backward in their sanitary development, the destruction of rodents still leaves much to be desired. Modern investigations show that much may be done to eradicate endemic plague if rats and other rodents are exterminated, and human dwellings rendered rat-proof. But, in Eastern countries especially, the native populations are apathetic, and take little or no pains to destroy rats, or otherwise prevent the occurrence of the disease. As will be seen in the pages that follow, India has suffered most from the ravages of the disease. Since 1896, approximately 10 millions of persons have already been carried off by the scourge in that country.

As in former reports, the plan followed is to give an account of the incidence of plague in each country, along with the circumstances associated with the occurrence of the disease; where possible, the measures employed to combat the malady are described. India is dealt with first, as it has been the chief reservoir of the infection for a long period.

INDIA.

The Annual Report of the Sanitary Commissioner with the Government of India for 1914 shows that 296,623 deaths from plague were recorded during the year, compared with 217,869 in 1913 and 306,488 in 1912. In 1914, as in 1913, the largest number of deaths from the disease was referred to the United Provinces of Agra and Oudh, in which 103,954 fatal cases were reported, or 35 per cent. of the total number reported in the whole of India. The Punjab occupied the second place with 73,627 deaths; and Bihar and Orissa came next with 64,334. The Presidency of Bombay was fourth on the list, having 20,060 deaths. These four administrative areas with a combined population of about 132½ millions, or a little over 42 per cent. of the population of India, contributed among them 261,975 deaths from plague in 1914, or 88·3 per cent. of the mortality recorded for that year from the disease in India. Some of the Indian provinces, as before, remained almost entirely free from the infection, while some others again escaped comparatively lightly from the ravages of the malady. This unequal distribution of plague mortality in India continues to be the subject of investigation by experts. So far as can be gathered from reports already published, the immunity of some of the provinces appears to be due partly to the habits and customs of the people and the construction of their dwellings, which do not favour infestation by rats.

In 1915 the number of fatal cases of plague rose to 438,866, and the provinces which suffered most were the Punjab, with 244,104 deaths (or 55·6 per cent. of the total), the United Provinces of Agra and Oudh with 58,128, Bombay Presidency with 43,824, and Bihar and Orissa with 27,241. Thus, these four administrative areas supplied no fewer than 373,297, or 85 per cent. of the total plague mortality in India during the year.

In 1916 the deaths from plague fell to 276,195, the largest mortality being recorded in the Presidency of Bombay, which took the first place with 79,507 deaths, or 28·8 per cent. of the total; the United Provinces coming second, with 49,368; the third being the Native State of Hyderabad with 44,548, and the fourth being the Central Provinces and Berar with 28,629. In 1916 Bihar and Orissa was fifth with 25,349, the Punjab occupying the ninth place with only 4,151 plague deaths.

There was a considerable increase in the deaths recorded from plague in India during 1917, no fewer than 587,404 fatal cases being reported compared with 276,195 in the previous year; that is, there were 311,209 more plague deaths in 1917 than in 1916. The province that suffered most was the Bombay Presidency, in which 162,874 fatal cases were recorded, or 27·7 per cent. of the total plague mortality in India for the year. The United Provinces of Agra and Oudh came second with 129,084 deaths. The third place was taken in 1917 by the Native State of Hyderabad, in which 54,674 fatal cases were recorded; the Central Provinces coming fourth with 48,036 plague deaths, and Bihar and Orissa being fifth with 45,436. It is somewhat noteworthy that the Punjab which, taking the whole period of 22 years since plague invaded India, has had the largest total number of deaths during that period, occupied in 1917 the eleventh place in point of the number of plague deaths recorded in the various provinces of India, only 9,724 deaths having occurred in it, as compared with an annual average of 159,850 for the 10 years period 1906 to 1915. The suggested explanation of this remarkable decrease of plague mortality in the Punjab during 1916 and 1917 is discussed further on.

Unfortunately, the mortality from plague recorded in India in the first half of 1918 showed a decided increase, and the Punjab again was placed among the provinces which suffered most from the annual epidemic, no fewer than 100,359 deaths being referred to this province out of the total of 538,959 fatal plague cases recorded in the whole of India in the first six months of 1918.

The following table gives the number of deaths from plague reported in India year by year from 1896 to 1917, along with the plague mortality rates per 1,000 of the population :—

The Plague Mortality in India for 22 years, 1896 *to* 1917.

Year.	Number of Reported Deaths from Plague.	Death Rate from Plague per 1,000 of the Population.
1896 - -	2,219	—
1897 - -	53,816	—

Year.	Number of Reported Deaths from Plague.	Death Rate from Plague per 1,000 of the Population.
1898 - -	116,285	—
1899 - -	139,009	—
1900 - -	92,807	0·34
1901 - -	283,788	1·05
1902 - -	583,937	2·00
1903 - -	865,578	3·13
1904 - -	1,143,993	4·20
1905 - -	1,069,140	4·22
1906 - -	356,721	1·32
1907 - -	1,315,892	5·16
1908 - -	156,480	0·50
1909 - -	178,808	0·64
1910 - -	512,605	1·83
1911 - -	846,873	3·07
1912 - -	306,488	1·10
1913 - -	217,869	0·83
1914 - -	296,623	1·12
1915 - -	438,866	1·60
1916 - -	276,195	0·86
1917 - -	587,404	1·83
Total in 22 years -	9,841,396	

The population of India at the census of 1911 was 315,156,396.

A short retrospect of plague in India since 1896 may be allowed here. The disease first appeared at Bombay in the early autumn of 1896, having apparently been introduced from some port of the Far East, probably Hong Kong, where the disease was prevalent at the time. Up to the end of 1917 the officially reported deaths from plague in India reached a total of 9,841,396. But this number was in all probability exceeded, since many deaths among the natives are not medically certified and, in many instances, fatal plague cases are returned by village-headmen under some other name in order to conceal the presence of the malady and avoid the temporary interference with the natives' mode of life occasioned when plague officials are trying to eradicate the infection. The plague prevalence in India reached its greatest intensity in 1907, in which year no fewer than 1,315,892 persons died of the disease. The number of plague deaths in 1908 was 156,480, and in 1909, 178,808. But since then the annual average number of fatal cases has been 435,365. Of the total plague deaths during the 22 years' period, 7,322,345, or 74·4 per cent., occurred in the three following administrative areas, namely: (1) the Punjab; (2) the Bombay Presidency, and (3) the United Provinces of Agra and Oudh. These three areas have a combined population of over 98 millions

The population and number of plague deaths in each of the three areas is shown below:—

Administrative Area.	Population in 1911.	Plague Deaths, 1896 to 1917.
The Punjab - -	24,187,750	2,862,852
Bombay Presidency	27,084,317	2,257,682
United Provinces -	47,182,044	2,201,811
Total - -	98,454,111	7,322,345

The causes which have contributed to prolong the prevalence of plague in India have already been discussed in previous reports. Much has been done by the Plague Commissions and by the investigations of the experts employed by the Advisory Committee, appointed jointly by the Secretary of State for India, the Royal Society and the Lister Institute, to throw light upon the etiology and prevention of plague; and the labours of individual members of the Indian Medical Service have helped to solve some of the pressing problems by work done in the laboratory and in the field. Notwithstanding all this, the fact remains that plague has shown no obvious tendency, up to the time of writing, to cease its ravages in India. It may be asked why, after so much has been discovered as to the ways in which plague spreads and the methods by which it can be prevented, no appreciable effect has been obtained in reducing the mortality? The answer to this is that, in all probability, the natives of India are themselves largely responsible for the failure of the anti-plague measures. The people of India regard some of the most useful regulations as affronts to their religion or a violation of their long-established native customs. Political agitators, no doubt, add fuel to the flames by fanning the fanatical spirit of some sections of the population with fabricated reports of the encroachments of the British officials on the sanctity of the Indian's home and religion. Even so simple a measure as destruction of rats has met with active opposition, some of it of a religious kind. Isolation of the sick has, in the past, been strenuously resisted; medical women were mobbed on their visiting rounds; plague officials were stoned in the streets; riots followed, and British soldiers were killed; isolation hospitals were burned down, some of the men employed to guard them being killed and their bodies thrown into the burning hospitals. At least two important British officials were assassinated in tragic circumstances under the belief that they were responsible for having introduced the obnoxious anti-plague regulations in a particular district. The murderers of these two officials, however, were brought to justice and executed for the crime.

In view of these and other circumstances, the Indian Government had to change their policy; and, later, orders were given to modify the enforcement of the anti-plague regulations. Hope was expressed that, by education, the people might, in time, come to recognise the value of the preventive measures, and spontaneously carry them out. No doubt the education of the native people is progressing, but it has not gone far enough as yet to effect much improvement on the incidence of fatal plague in India, judging by the mortality returns.

Recent reports on plague investigations in India, issued by the Advisory Committee already referred to, show that, as a result of observations carried out in the United Provinces, there is a definite plague season; and that the association of unusual humidity during the winter months, in certain districts, with severe epidemics of plague, is so constant a phenomenon that the conclusion is justified that one stands to the other as cause to effect. There are also grounds for believing that this cause exercises its effect mainly through its influence on the length of the life of rat fleas when separated from their host, for, the longer a rat flea is able to survive in such circumstances the greater are its opportunities, in an infected area, for conveying the plague bacillus either to rats or human beings.*

Dr. Ralph St. John Brooks, Secretary to the Advisory Committee, has also investigated recently the effect of hot weather on epidemic plague. His conclusions were that, in India, plague does not maintain itself in epidemic form when the temperature rises above 80° F. accompanied by a saturation deficiency† of over 0·30 of an inch. Plague epidemics are rapidly brought to an end in the presence of a high saturation deficiency even when the mean temperature throughout and after the termination of the epidemic has been considerably below 80° F. These epidemics may commence and increase in intensity when the mean temperature is well above 80° F. provided that the saturation deficiency is below 0·30 of an inch. In some districts of India, and in certain tropical islands where the climatic conditions are at all times of the year favourable to the incidence and spread of plague, the disease may occur indifferently at all seasons. The adverse influence of high temperature and saturation deficiency are explained by their effect on the duration of the life of the rat flea.‡ The number of fleas found on rats in India is greatest in the cold months and least in the hot season.

In a paper published in the *Indian Journal of Medical Research*,§ Major F. Norman White, C.I.E., the Sanitary Commissioner with the Government of India,‖ gives a general review of the outbreaks of plague in that country during the last 20 years ended 30th June, 1918, during which time more than $10\frac{1}{4}$ millions of the people of India have died of plague. He takes for his purpose, not the calendar year, but "the plague year" beginning on 1st July and ending on 30th June following. On the average of 20 years, July is the month that yields the fewest deaths from plague in India, and March the most. The curve begins to rise in the later months of the year and reaches its greatest height in March and April, and then falling rapidly in May and June. The monthly incidence of plague mortality in India during the 20-year period 1898 to 1918 is shewn in the table on the following page.

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* Tenth Report on Plague Investigations in India: Epidemiological Observations in the United Provinces of Agra and Oudh. By Majors Gloster and White, I.M.S., assisted by others. 1917.

† By "saturation deficiency" is meant "the difference between the actual tension of aqueous vapour present in the atmosphere at the temperature in question, and the tension of aqueous vapour that would be present in a saturated atmosphere at the same temperature."

‡ Tenth Report on Plague Investigations in India. 1917.

§ Vol.VI., No. 2.

‖ Now a member of the Medical Department of the Ministry of Health.

From this table, which deals with "the plague year" (July–June), it will be seen that the four most severe outbreaks of plague in India during these 20 years were (1) in 1904–5, when 1,328,249 deaths were recorded; (2) in 1906–7, when 1,286,513 fatal cases occurred; (3) in 1903–4, when 1,138,451 persons lost their lives from the disease, and (4) in 1917–18, when the plague deaths numbered 820,292. On the other hand, the mildest outbreaks were those of (1) 1898–99, and (2) 1908–9, when the fatal cases numbered only 119,045 and 126,442 respectively.

It is suggested in Major White's report, mentioned above, that in some localities the virulence of plague is decreasing, and that this is probably due to the increasing immunity of the Indian rat to plague. But, while in certain places this may be the case, there is at the time this report is written no indication that this immunity is anything like general. The fact that the plague year 1917–18 was one of the worst that had been experienced for 10 years gives no sign of a speedy subsidence of the disease in India; for this reason no relaxation of efforts to combat the disease should be permitted.*

At a plague conference held at Indore in April, 1918, under the presidency of Lieut.-Colonel F. A. Smith, I.M.S., Administrative Medical Officer in Central India, and attended by Chief Medical Officers, State Surgeons, and Health Officers, and by Major Norman White, C.I.E., I.M.S., Sanitary Commissioner with the Government of India, a number of resolutions were passed after full discussion. Among these were the following:—

"Plague, in India, is essentially a disease of rats, and its prevalence is proportionate to the degree of rat infestation, which in its turn is directly determined by the amount of food and shelter for rats that any given place affords. It follows that

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* Since the above was written there has certainly been a large reduction in the mortality of plague in India in the second half of 1918 and the first half of 1919. While, in the first half of 1918, the plague deaths amounted to 538,959, in the second half the total was only 34,497, and, for the first six months of 1919, 53,027.

There have been previous drops in the plague mortality, but perhaps never so great as this. It is too soon, however, to judge whether the reduction is going to be continued and the protracted prevalence of the disease in India come to an end.

*Table showing the Deaths from Plague in India, Month by Month, for a Period of 20 Years, 1898 to 1918.**

Plague Year.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	March.	April.	May.	June.	Total.	Plague Death Rate per 1,000 of the Population.
1898–9 - -	2,539	6,569	11,307	19,153	16,789	11,480	11,486	11,739	13,236	7,792	4,317	2,638	119,045	0·42
1899–1900 -	10,021	18,440	22,058	20,805	9,962	6,515	7,689	10,716	19,290	12,611	3,964	1,137	143,208	0·51
1900–1 - -	835	2,072	6,411	10,025	8,621	9,434	14,093	23,582	45,129	28,931	9,434	3,812	162,379	0·55
1901–2 - -	7,451	15,250	27,608	35,732	35,761	37,005	47,949	68,344	10,729	87,133	34,582	6,597	514,141	1·75
1902–3 - -	6,715	18,775	37,490	48,585	47,531	69,507	89,006	109,248	138,129	126,703	56,926	20,068	768,683	2·61
1903–4 - -	11,941	29,374	56,555	75,076	76,003	76,444	94,334	120,379	199,905	245,171	132,795	20,469	1,138,451	3·87
1904–5 - -	12,622	34,303	54,876	70,073	65,882	91,785	144,283	142,745	256,374	276,874	161,435	16,997	1,328,249	4·51
1905–6 - -	4,423	8,702	14,108	14,533	12,732	15,934	19,612	32,423	62,411	77,328	43,870	5,869	311,945	1·06
1906–7 - -	2,855	7,939	19,359	23,901	23,801	37,362	65,257	115,036	257,078	372,750	294,888	66,296	1,286,513	4·37
1907–8 - -	14,883	16,272	37,170	40,914	20,909	14,254	14,205	22,966	35,383	28,555	11,859	2,709	260,079	0·88
1908–9 - -	2,177	4,601	8,406	9,883	7,971	7,765	11,050	14,133	22,358	19,086	15,703	3,309	126,442	0·43
1909–10 - -	2,859	6,663	12,803	18,733	19,446	32,665	56,632	79,871	122,647	92,872	44,595	5,365	495,151	1·68
1910–11 - -	2,868	6,071	11,538	16,746	28,570	44,830	92,033	103,510	185,695	188,262	97,849	14,376	792,348	2·69
1911–12 - -	7,922	16,589	31,360	39,164	32,386	37,727	55,198	66,316	74,901	50,339	17,629	2,974	432,505	1·37
1912–13 - -	1,277	2,920	5,790	7,260	9,084	12,800	16,023	24,449	50,065	48,817	13,111	4,085	195,681	0·62
1913–14 - -	4,169	4,918	7,066	9,266	13,297	22,603	35,722	44,373	75,555	57,968	30,157	6,321	311,415	0·99
1914–15 - -	1,730	3,260	5,698	7,290	9,395	19,154	29,149	54,507	94,280	118,088	59,016	5,766	407,333	1·29
1915–16 - -	2,694	6,014	9,521	15,291	16,382	23,158	32,217	37,564	42,715	16,193	3,918	1,686	207,353	0·66
1916–17 - -	5,831	13,207	17,701	24,779	31,400	48,984	63,520	74,628	75,636	49,067	20,522	7,733	433,008	1·37
1917–18 - -	12,872	24,862	35,327	47,810	63,706	96,756	129,736	140,983	140,491	84,198	36,568	6,983	820,292	2·60
Mean Monthly Mortality from Plague -	5,934	12,340	21,607	27,750	27,481	35,808	51,459	64,875	101,100	99,436	54,656	10,259	512,711	

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* The figures are taken from Major F. Norman White's report on "Twenty Years of Plague in India," published in the *Indian Journal of Medical Research*, Vol. VI., No. 2.

It will be noted that the table does not deal with calendar years.

all measures designed to limit the food available for rats are plague measures of great importance. The protection of food supplies from the depredations of rats, efficient scavenging, house tidiness, and the raising of the sanitary standard of town or village, are important anti-plague measures." Another resolution was to the effect that "when human or rat plague is present, inoculation of the community with anti-plague vaccine, and the evacuation of infected dwellings, result in a very great saving of life. Certain forms of merchandise, especially grain, are more dangerous as vehicles of plague infection than the human being *per se*. Such merchandise affords unequalled facilities for the transference of rats and fleas over long distances."

The use of anti-plague inoculation continues to make progress in India. Major W. Glen Liston, I.M.S., in his reports on the Bombay Bacteriological Laboratory, Parel, gives the following figures showing the output of anti-plague vaccine during a period of six years :—

Year.	Doses of Anti-Plague Vaccine sent out.
1912	727,377
1913	795,637
1914	812,942
1915	827,407
1916	1,404,008
1917	1,821,661

In 1918, 1,543,099 doses were issued.

The distribution of the anti-plague vaccine among the various parts of India during 1915, 1916, and 1917 is given below* :—

Doses of Anti-Plague Vaccine.

——	1915.	1916.	1917.
Provinces.			
Bombay Presidency	175,172	277,185	314,822
Madras Presidency	79.635	120,620	77,866
Bengal, Behar and Assam	9,425	9,260	16,531
United Provinces of Agra and Oudh	52,800	76.750	154,325
Punjab	194,725	30,010	87,706
North-West Frontier Province	6,425	900	2.050
Central Provinces and Berar	81,000	140,575	154,015
Burma	65,010	56,015	116 850
Native States of India	91,085	502,958	540,275
Countries outside India	72,075	188.445	353,581
Portuguese India	55	1,290	3,640

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* Report on the Bombay Bacteriological Laboratory at Parel, for the three years 1915, 1916 and 1917, by Major W. Glen Liston, I.M.S.

The demand for the prophylactic vaccine is greatest when plague becomes epidemic in a province, but when the danger seems past the number of inoculations diminishes quickly.

The incidence of plague during the four years 1914, 1915, 1916, and 1917 in the different provinces of India will now be considered in detail.

The Presidency of Bombay.

The incidence of plague in the Presidency of Bombay showed some decrease during 1914, for 20,060 deaths from the disease were reported as against 27,573 in 1913 and 33,024 in 1912. The plague death-rate per 1,000 living was 1·02 in 1914 and 1·29 in 1913, the mean of the previous five years being 2·11. This diminution in the amount of the disease has been going on for some time, and if the six years ended 1908 be compared with the six years ended 1914 it will be found that during the first of these periods a total of 749,068 deaths from plague were recorded in British districts of the Presidency, giving an annual average of 124,845; while in the second six-year period the fatal plague cases amounted to 224,093, or a yearly average of 37,349.* The decrease would have been far greater but for the considerable rise in plague mortality which took place in 1911, when the deaths from this cause numbered 100,399 (or. if the Native States be included also, 117,868).

Of these fatal cases. in 1914, 10,694 were males and 9,366 females. Out of the 27 districts included in the province only two contributed no deaths from plague during the year, namely. West Khandesh and Upper Sind, the populations of which are respectively 580,680 and 262,983. The districts which suffered most were Dharwar (population over a million), which had 3,090 deaths and a death-rate from plague of 3·01 per 1,000 of its population; and Belgaum (population 941,948) with 2,988 fatal cases and a plague death-rate of 3·17 per 1,000.

The total number of inoculations with Haffkine's prophylactic performed in the Presidency during 1914 was 62,497 as against 175,456 in 1913. The largest number of inoculations was reported in Dharwar. where 16,670 persons received this protection against plague. It appears that 92 persons who had been inoculated were subsequently attacked by plague and 40 of them died, the corresponding figures for 1913 having been 344 attacks and 113 deaths. The Sanitary Commissioner states that it is not easy to give the exact period intervening between the inoculation and the attack by plague, but it seems probable from the information supplied that 34 out of the 92 attacks occurred within seven to ten days of the inoculation and that the case mortality was exactly 50 per cent.*

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* Annual Report of the Sanitary Commissioner for the Government of Bombay for 1914, by Major F. H. G. Hutchinson, I.M.S.

A rat destruction campaign was carried out in several districts, but the total number of rats killed during the year in the Presidency has not been given. The most universally employed anti-plague measure was evacuation, but, unfortunately, it is at present imperfectly carried out.

During 1915 there was a considerable increase in the amount of plague recorded in this Presidency as compared with the three previous years. At the time of writing the final figures from India have not been received, but in the bulletin of the Office International d'Hygiène Publique for January 1916 the total number of plague attacks in Bombay and Sind is given as 65,558; and the deaths, according to the Sanitary Commissioner, amounted to 43,824. The height of the prevalence in the first half of 1915 was reached, as usual, in April, and the minimum in June. But in the second half of the year there was a recrudescence which reached its greatest point in October, in which month nearly 9,000 deaths were reported, but which continued with little diminished severity well into 1916, nearly 20,000 plague deaths being recorded in the first three months of that year.

Of the 43,824 fatal cases, 21,943 were males and 21,881 females. The plague death-rate was 2·24 per 1,000 living, compared with a rate of 1·02 in the previous year and a mean rate for the five preceding years of 2·0. The districts which suffered the most were Belgaum, with 9,526 deaths, giving a plague mortality rate of 10·11; Sholapur, 7,709 fatal cases, with a rate of 10·12; and West Khandesh, 7,139 deaths, with a plague death-rate of 7·90 per 1,000 of the population.

Inoculation is still unpopular with the bulk of the people in the Presidency, but, under stress of a threatened epidemic in a particular town or district, many of the inhabitants will sink their prejudices and present themselves for inoculation. During 1915 there were 128,800 inoculations performed against 62,497 in the previous year. Of the total number inoculated in 1915, 91 died subsequently from plague, but 61 of them, or nearly 70 per cent., occurred within a month of the inoculation. In the opinion of Major Hutchinson, the Sanitary Commissioner,* the important towns of the Presidency can be largely protected from plague by the constant trapping of rats, the two secrets of success being (1) that the trapping is continued throughout the year, and (2) a sufficiency of traps. He mentions that the town of Satara, with 18,665 inhabitants, has been free from plague for two years at a cost of about a rupee per house. He therefore asks the inhabitants of the important towns the question: "Is freedom from plague worth the average annual expenditure of one rupee per house?"

In 1916 plague caused 79,507 deaths in the Bombay Presidency (39,100 being males and 40,407 females), giving a death-rate of

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* Annual Report of the Sanitary Commissioner for the Government of Bombay for the year 1915.

4·06 per 1,000 of the population against a mean rate for the previous five years of 2·23. The district which suffered most during the year was Sholapur, with 14,021 deaths, giving a death-rate of 18·25 per 1,000. Poona came next with 10,945 deaths, equal to a death-rate of 10·28; Ahmednagar being third with 10,352, and a rate of 10·97 per 1,000 of its population. During the year 211,960 persons were inoculated; of these 320 were reported to have died subsequently from plague, 156 of them occurring within the incubation period of plague, that is, before protection had been conferred by the inoculation. The value of the prophylactic was shown by the immunity of Indian regiments and followers and of the inmates of jails, all of whom had been inoculated. During 1917 there was a great increase in the amount of plague mortality recorded in the Bombay Presidency, no fewer than 162,874 deaths being reported, and of these 66,295 occurred during the last quarter of the year. Of the 162,874 plague deaths, 159,858 were referred to the British districts. Of the total deaths from plague, 80,246 were males and 82,628 females. The death-rate from the disease was 8·31, against a mean rate of 2·02 during the previous five years. The district in which the largest number of plague deaths occurred was Satara, in which 31,881 fatal cases were registered, giving a death-rate of 29·50 per 1,000 from the disease. East Khandesh had 17,817 plague deaths; Sholapur, 13,975; and Nasik, 12,766. In his Annual Report for 1917* the Sanitary Commissioner remarks that "As the number of rats varies directly with the abundance of available food supply, rat infestation, associated as it is with human plague, must be taken as an index of prosperity. Conversely, famine followed by a reduction in the number of rats means invariably little or no plague. The reason for any abnormality in the incidence of plague will always be found in the grain trade. In the grain-producing districts restrictions on export by rail must, in a prosperous year, lead to increased local distribution and storages. Districts like Gujarat, into which large quantities of grain are imported, share with the grain-producing districts the danger of agricultural prosperity."

During 1917, 241,139 persons were inoculated in the Presidency against 211,960 in the previous year; 587 persons who had been inoculated contracted plague during the year and 215 of them died. Of these, 190 had been inoculated during the incubation period of the disease, that is, too late to prevent its development, and 97 of them died, giving a fatality-rate of 51·05 per cent.; 397 were attacked by plague at a later period and 118 of them succumbed, giving a fatality-rate of 29·7 per cent. The immunity of protected prisoners in jails is valuable testimony in favour of inoculation. The Sanitary Commissioner states that the high death-rate from plague in this Presidency in 1917 need cause no pessimism if the lessons taught are taken to heart. The epidemic has once more brought into prominence the importance of persistence of plague infection in hot weather, the danger of uncontrolled evacuation of infected towns, and the practical certainty of the infection of towns and villages connected with the supply of food grains. "If these three factors be eliminated, plague will lose its sting."

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* Annual Report of the Sanitary Commissioner for the Government of Bombay, 1917, by Lieut.-Col. F. H. G. Hutchinson, I.M.S.

The seasonal incidence of fatal plague in the Bombay Presidency during the four years 1914, 1915, 1916, and 1917 is shown in the following table :—

Deaths from Plague in the Bombay Presidency month by month. 1914 *to* 1917.

——	1914.	1915.	1916.	1917.
January - - - -	3,139	2,005	8,122	20,621
February - - -	2,430	2,313	6,847	22,091
March - - - -	2,629	3,705	4,247	12,795
April - - - -	2,472	2,521	1,721	5,857
May - - - -	1,210	1,323	751	2,766
June - - - -	339	810	572	1,768
July - - - -	507	1,758	2,150	5,279
August - - - -	1,018	3,993	5,069	9,760
September - - -	1,751	4,926	6,930	15,642
October - - - -	1,854	6,958	10,788	20,030
November - - -	1,411	6,748	13,637	22,850
December - - -	1,300	6,764	18,673	23,415
Total - -	20,060	43,824	79,507	162,874

The number of deaths registered from plague in 1917 was the largest that has been recorded during the past 13 years in this Presidency.

Since plague first appeared in this Presidency, in 1896, as has already been said, 2,257,682 of the inhabitants have died from the disease. The number of deaths from the disease, year by year, since 1896 is shown in the following table :—

Deaths from Plague in the Bombay Presidency 1896 *to* 1917.

Year.	Plague Deaths.
1896 - - - - - - -	2,219
1897 - - - - - - -	53,419
1898 - - - - - - -	103,863
1899 - - - - - - -	116,023

Year.	Plague Deaths.
1900	38,368
1901	158,080
1902	223,342
1903	363,752
1904	287,304
1905	94,375
1906	73,926
1907	147,795
1908	41,672
1909	32,601
1910	36,213
1911	117,868
1912	33,024
1913	27,573
1914	20,060
1915	43,824
1916	79,507
1917	162,874
Total in 22 years	2,257,682

The population of the Presidency at the 1911 census was 27,084,317, of which 7,411,675 were referred to Native States.

During the first half of 1918, 81,716 deaths from plague were recorded in the Presidency of Bombay.

THE CITY OF BOMBAY (population, 1911 census, 979,445).

The number of plague attacks reported in the City of Bombay during 1914 was 3,348, and of these 2,941 died, giving a case mortality rate, calculated on these figures, of 87·8 per cent. The corresponding figures for 1913 were 3,023 attacks and 2,609 deaths, the case mortality rate being 86·3 per cent.

Of the 2,941 fatal cases, 2,439 were Hindus; 333 were Mussulmans, including Negro-Africans; 102 Native Christians, and 57 Parsees; the remaining 10 deaths included four Jews, four Eurasians, and two Europeans. As regards sex distribution, 2,047 were males and 894 females; with respect to age, 1,582, or 53 per cent., were in the age-group 15 to 30 years; there was only one death under the age of 12 months.

The plague death-rate in the City was 3·0 per 1,000.

The anti-plague measures included inoculation, rat destruction, evacuation, and disinfection. Inoculation was performed upon 4,622 persons, against 5,488 in 1913; 6,886 in 1912; and 9,621 in 1911. The number of rats destroyed during the year was 644,241, as compared with 654,516 in 1913. Of the 644,241 rats collected, 210,080 were examined and 12,530, or 5·9 per cent., were found infected, against 5·3 per cent. in the previous year. The epizootic of plague among rats reached its height in April, when the percentage of infected rats found was 16·1. To assist in the evacuation of congested areas, municipal camps were established in various parts of Bombay. As has been the practice for some time past, every place where an infected rat was discovered was "pesterined," and all gulleys and passages between houses were similarly treated.*

During 1915 there was a marked decrease in the amount of plague recorded in this city, only 694 cases and 599 deaths coming under official notice, the smallest number reported in any year since plague appeared at Bombay.

Calculated on these figures the case mortality rate was 86·3 per cent. There were 441 deaths among males and 158 among females. The epidemic of plague in Bombay in 1915 was of the shortest duration as yet observed since plague invaded the City in 1896, as it practically lasted only four weeks, namely, from the week ended 17th April to 15th May, the remainder of the cases representing the local endemicity of the disease. Hindus of all classes contributed 480 of the total 599 deaths; Mussulmans, including Negro-Africans, 88; Native Christians, 21; the remaining 10 deaths occurring among all other communities together, excepting Europeans and Buddists, among whom no plague deaths were reported during 1915. The disease was most fatal to persons aged from 10 to 25 years. During 1915, 3,910 persons were inoculated; 703,705 rats were collected and destroyed, and of these 316,378 were examined at Parel Laboratory, 4,973 being found infected, a percentage of 1·57 as compared with 5·9 in 1914 and 5·3 in 1913.†

During 1916 the number of plague attacks in the City of Bombay was 2,321, of which 1,987 or 85·6 per cent. died; the plague death-rate being 2·02 per 1,000 of the population, as compared with ·61 in 1915. The annual epidemic lasted from the week ended 26th February to that ended 3rd June. Of the 1,987 plague deaths, 1,615 occurred among Hindus of all classes, 247 among Mussulmans, including Negro-Africans; 70 among Native Christians, and 43 among Parsees: the remaining 12 comprised six Europeans, five Jews, and one Eurasian. There were 1,437 deaths in males and 550 in females. The disease was most fatal in the age-group 10 to 30 years, 76 per cent. of the total occurring among persons of that age. There were only two deaths among infants. The number of persons who submitted to inoculation during the year was 4,931; 943,346 rats were destroyed, of which 441,871 were examined and 11,227 found infected by plague, the percentage of infected rats in those examined being 2·54. Evacuation of infected and congested areas was continued as an anti-plague measure during 1916, and health camps were provided.

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* Annual Report of the Executive Health Officer for the City of Bombay for the year 1914 by Dr. J. A. Turner.

† Annual Report of the Executive Health Officer for 1915.

During 1917 the cases and deaths recorded in the City from plague numbered respectively 1,987 and 1,706, the height of the prevalence occurring in March, April, and May.

Of the 1,706 deaths, 1,344 occurred among Hindus; 224 were registered among Mussulmans, including Negro-Africans; 69 were Christians: Parsees, 41, Jews, 5, and Europeans 3; 1,229 were males and 477 females. The disease, in 1917, was most fatal in the age-period 10 to 30 years, more than 66 per cent. of the total being referred to that age-group. There were no plague deaths under one year of age. The usual preventive measures included inoculation, rat destruction, evacuation, and disinfection: 4,070 inoculations were performed during the year; 995,739 rats were collected and destroyed, 501,632 were examined and 11,176 found infected. The percentage of infected rats to those examined was 2·22 as compared with 2·54 in 1916 and 1·57 in 1915.

The incidence of fatal plague, month by month, during the four years 1914, 1915, 1916, and 1917 is shown in the subjoined table :—

Deaths from Plague in Bombay City, 1914 *to* 1917.

—	1914.	1915.	1916.	1917.
January - - - -	59	7	44	47
February - - -	119	17	138	97
March - - - -	465	77	474	269
April - - - -	1,135	159	657	359
May - - - -	821	131	346	306
June - - - -	147	32	88	141
July - - - -	83	41	69	137
August - - - -	55	31	34	114
September - - -	35	28	34	72
October - - - -	10	23	39	71
November - - -	7	24	30	50
December - - -	5	29	34	43
Total - -	2,941	599	1,987	1,706

The progress of plague in the City of Bombay since its appearance there in August 1896 up to the end of 1915 is shown year by year in the appended table :—

Plague in the City of Bombay in the 22 Years, 1896 to 1917.

Year.	Cases.	Deaths.	Case-mortality Per cent.	Plague Death-rate per 1,000 of the Population.
1896	2,544	1,936	76·1	2·3
1897	13,314	11,003	82·6	13·3
1898	22,130	18,185	82·2	22·1
1899	19,451	15,796	81·2	19·2
1900	17,913	13,285	74·2	16·1
1901	21,006	18,736	89·2	24·1
1902	16,423	13,820	84·2	17·8
1903	23.344	20,788	89·1	26·7
1904	15,488	13,538	87·4	17·4
1905	16,303	14,198	87·1	18·2
1906	12,323	10,823	87·8	11·0
1907	7.353	6,389	86·9	6·5
1908	6,134	5,361	87·4	5·4
1909	5,864	5,197	88·6	5·3
1910	4,130	3,656	88·5	3·7
1911	4,503	4,006	88·9	4·0
1912	1,936	1,717	88·7	1·7
1913	3,023	2,609	86·3	2·6
1914	3,348	2.941	87·8	3·0
1915	694	599	86·3	0·6
1916	2,321	1,987	85·6	2·4
1917	1,987	1,706	85·8	1·7
Total for 22 years	221,532	188,276	85·0	10·2

The population of the city of Bombay at the 1911 census was 979.445.

During the first six months of 1918 the deaths from plague in the city of Bombay amounted to 1,045.

THE PORT OF BOMBAY.

Six cases of plague in connection with shipping were reported during 1914 in the port of Bombay. Two of them were on board incoming vessels and four on ships and native craft lying in the harbour. During the year, 53 vessels were fumigated by means of Clayton's apparatus, under the direction of the port medical officer; and, in addition, 11 coal lighters and two prows were fumigated by burning sulphur in braziers. Fourteen vessels belonging to the British India Steam Navigation Company were fumigated by their own apparatus, under direction of the port health officers.*

During 1915 only one case of plague occurred in the port in connection with shipping; 93 vessels were fumigated, 57 of them by Claytons' process, after which 637 dead rats were found.†

During 1916, 18 cases of plague were reported in connection with shipping, six of which occurred on incoming vessels, seven were detected on outgoing ships, and five were discovered on vessels and native craft lying in the harbour and docks.

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* Annual Report of the Health Officer of the Port of Bombay for the year ending 31st December 1914, by Lieut.-Col. W. E. Jennings, I.M.S.

† Lieut.-Col. W. E. Jennings's Annual Report for 1915.

In 1916, 116 vessels were disinfected and fumigated; of these, 51 were done by Clayton's process, including three outward bound pilgrim vessels, on which 669 dead rats were afterwards found as well as "innumerable cockroaches."* One of the rats was found to be plague-infected by bacteriological examination conducted at the Parel Laboratory. In addition the British India Steam Navigation Company had 15 of their vessels fumigated by their own Clayton's apparatus, as also two other steamers under the supervision of the port health officers.

During 1917 there were 19 cases of plague reported in the port, namely, 2 on board vessels arriving at Bombay, and 17 on vessels in the harbour and docks. During the year 108 ships of all sorts were disinfected and fumigated, of which 52, belonging to the British India Steam Navigation Company, were fumigated with their own Clayton apparatus.†

In continuation of the tables given in previous summaries, the appended tabular statement gives the number of vessels inspected each year from 1897 to 1916, the number of persons medically examined, and the number of plague cases discovered on these vessels :—

Port of Bombay : Inspection of Shipping.

Year.	Number of Vessels inspected.	Number of Persons examined.	Number of Plague Cases discovered.
1897 - - - -	72.808	1,313,117	169
1898 - - - -	71,498	1,207,571	236
1899 - - - -	65,822	1,193,339	155
1900 - - - -	65,966	1,173,050	84
1901 - - - -	34,637	886,310	73
1902 - - - -	15,432	701,964	44
1903 - - - -	14,597	719,322	77
1904 - - - -	15,154	751,039	58
1905 - - - -	14,197	838,953	27
1906 - - - -	14,460	948,411	33
1907 - - - -	11,708	894,848	19
1908 - - - -	2,472	235,066	10
1909 - - - -	954	177,870	5
1910 - - - -	1,012	176,925	18
1911 - - - -	1,057	205,207	7
1912 - - - -	1,058	194,954	13
1913 - - - -	992	181,497	1
1914 - - - -	1,099	309,121	6
1915 - - - -	950	203,880	1
1916 - - - -	1 253	365,956	18
1917 - - - -	1,482	554,110	19
Total - -	408,608	13,232,510	1.073

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* Annual Report of the Health Officer of the Port of Bombay for 1916, by Major W. M. Houston, I.M.S.

† Annual Report of the Health Officer of the Port of Bombay for 1917, by Major W. M. Houston, I.M.S.

The Port of Karachi.

In the municipality of Karachi 1,009 deaths from plague were recorded during 1914 in a population of 140,511 (1911 census), as compared with 435 fatal cases in 1913. But during 1914 only one instance of plague occurred in connection with shipping, namely, the ss. *Lindula*, which arrived at Karachi from the Persian Gulf in April, and reported that a Goanese member of the crew was suffering from plague. The patient was at once landed and conveyed to the hospital, and, after the usual precautions had been taken, the vessel continued its voyage to Bombay.

During 1914, 15 vessels were fumigated by means of Clayton's apparatus, 12 of them at the request of their agents before sailing for ports out of India; the other three vessels were pilgrim ships.

Plague continued to be epidemic in Karachi Town during 1915, the cases numbering 1,346 and the deaths 1,108, the chief prevalence occurring during the months of April, May, and June. But there was no plague case in connection with shipping in the port. Three vessels were fumigated during the year by means of Clayton's apparatus by request of the shipping agents.

In 1916 there were only 113 deaths from plague in the town of Karachi as compared with 1,108 in the previous year. In Karachi port two cases were removed from incoming ships to the Epidemic Diseases Hospital. These vessels were fumigated by Clayton's apparatus, and other precautions taken. Altogether during 1916 eight ships were fumigated by the Clayton method before sailing for ports out of India.

There were 1,153 deaths from plague in the town of Karachi in 1917. As to plague in the port during the year, there were 19 reported cases among the Indian crews of incoming vessels, namely, 16 on a Government ship and three on a non-Government vessel. In both of these ships the outbreak was preceded by an observed mortality among the rats on board. Rats caught on the vessel after arrival at Karachi proved to be plague-infected. Both ships were fumigated by Clayton's apparatus and, in addition, the entire effects (clothing, bedding; &c.) of the crews was disinfected by steam at the disinfecting station by an Equifex apparatus. The rest of the crew were segregated for a time in a camp on shore and were inoculated with Haffkine's prophylactic. There were no fresh cases.

Two plague infected rats were found on a hopper dredger in the harbour, but no human cases supervened in the crew.*

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* Annual Report of the Health Officer of the Port of Karachi for 1917, by Dr. H. Carey Venis.

The Madras Presidency.

According to the Annual Report of the Acting Sanitary Commissioner,* the deaths from plague in the Madras Presidency during 1914 numbered 5,102, as compared with 5,130 in the previous year. Of these 5,102 deaths, 2,547 were referred to the town districts and 2,555 to the rural areas of the province. According to the "weekly preliminary statements" the total number of persons attacked in 1914 by plague in the Presidency was 7,523. Calculated on these figures the case mortality rate was 67·8 per cent. Of the 5,102 deaths, 2,426 were males and 2,676 females. The course of the 1914 prevalence is shown, month by month, in the subjoined table :—

Plague in Madras Presidency in 1914.

1914.	Cases.	Deaths.
January	2,965	1,733
February	1,416	952
March	598	432
April	132	75
May	17	16
June	10	9
July	69	52
August	62	46
September	261	153
October	653	611
November	822	627
December	518	396
Total	7,523	5,102

The population of the Madras Presidency at the 1911 census was 46,217,245, and of this number 4,811,841 were referred to the Native States within the province. The death rate from plague in 1914 was 0·1 per 1,000 of the population, the mean of the previous five years having been 0·2. Of the total 25 districts into which the Presidency is divided for administrative purposes, eight were completely free from plague during the year; in six others only a few imported instances were reported, the recorded cases already given being distributed over the 11 remaining districts, the chief sufferers among which were North Arcot, with 1,826 deaths and a rate of 0·9 per 1,000 living; Bellary, with 1,405 fatal cases, the death-rate being 1·4; and Coimbatore, with 1,078 deaths, and a rate of 0·5 per 1,000. Deaths from plague occurred in 351 towns and villages against 635 in the previous year. Only three imported cases, with two deaths, were recorded in 1914 in the city of Madras, with its population of more than half a million, as against three fatal cases in 1913. The almost complete immunity of this city from plague has been discussed already in previous reports.* The total number of rats destroyed in the city during 1914 was 123.389 against 124.217 in the previous year, making a total of 1,826,974 since the commencement of the campaign against rats.

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* Annual Report of the Sanitary Commissioner with the Government of Madras for 1914, by Lieut.-Colonel H. Thomson, I.M.S., Acting Sanitary Commissioner.

The same measures as formerly were employed against the disease, including disinfection of houses and of persons, along with their effects; isolation of the sick and segregation of the contacts; destruction of rats by poisoning or trapping; and inoculation, by Haffkine's method, of all persons willing to receive it. A total of 37 persons in 1914 died of plague, who had previously been inoculated; but the period which had elapsed between the inoculation and the attack of plague is not stated in the report of the Acting Sanitary Commissioner, nor is the total number given of persons inoculated during the year.

In 1915 the amount of reported plague in the Madras Presidency was less than in any of the five previous years, the cases numbering 5,197 and the deaths 3,889, giving a fatality-rate of 74·8 per cent. The course of the plague prevalence, month by month, during 1915 is shown in the subjoined table :—

Plague in Madras Presidency in 1915.

1915.	Cases.	Deaths.
January - - - - - -	476	396
February - - - - -	499	384
March - - - - - -	344	262
April - - - - - -	76	43
May - - - - - -	44	18
June - - - - - -	15	5
July - - - - - -	36	28
August - - - - - -	239	182
September - - - - -	460	343
October - - - - - -	686	504
November - - - - -	688	572
December - - - - -	1,634	1,152
Total - - - -	5,197	3,889

This table shows that at the end of 1915 plague was increasing in amount in the Madras Presidency, and this increase continued during the first quarter of 1916, in which period no fewer than 5,334 other cases and 3,675 deaths from the disease were recorded.

Apparently there were no reported instances of plague in the city of Madras during 1915. Eleven districts remained quite free from plague during the year; in four others there were altogether six imported cases, and in the remaining 10 districts the rest of the 3,889 plague deaths were reported. The districts in which the largest number of plague deaths occurred in the Madras Presidency in 1915, were—Salem which had 1,506 fatal cases; and Bellary, which had 1,225. Deaths from the disease were recorded in 292 towns and villages against 351 in the previous year. Among persons who had been inoculated, 64 deaths occurred, as compared with 37 in 1914; but no details of these instances have so far been published. The total anti-plague inoculations performed during 1915 amounted to 52,996. Large numbers of houses were evacuated, and rat destruction was carried out in at least eight of the districts.*

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* *Vide* Annual Report of the Medical Officer to the Local Government Board for 1912–13, pages 14 and 15.

In 1916 the number of deaths from plague rose to 11,498, that is, 7,609 more than in the previous year, the death-rate being 0·3 per 1,000 against a mean rate of 0·2 for the previous five years. The districts which gave the largest number of fatal cases were Coimbatore, which had 5,582 deaths, and Salem, which had 2,564. Eight districts remained entirely free from plague during the year, and in six others a total of 21 imported cases were reported. Deaths from plague were recorded in 848 towns and villages against 292 in 1915. There were 17 cases and 11 deaths from plague in the city of Madras, as compared with none in 1915 and two in 1914. All the cases in 1916 were imported instances. Among inoculated persons in the Presidency (the number of whom is not given), 85 deaths are said to have occurred during 1916, against 64 in the previous year; but no particulars of these cases are supplied by the Sanitary Commissioner in his Annual Report for 1916, from which the above information has been obtained.

There were 17 cases of plague reported in the city of Madras in 1916, 11 of which proved fatal; all were imported cases.

In 1917, plague continued to be very prevalent, 24,708 deaths being recorded from the disease, giving a death-rate of 0·6 per 1,000 of the population. This is the largest number of fatal cases occurring in any year since the infection was introduced into the Presidency in 1898. The nearest approach to this number was in 1904, when the plague deaths amounted to 20,129. The following table gives the distribution of the fatal cases throughout the months of the two years 1916 and 1917:—

Deaths from Plague in the Madras Presidency in 1916 *and* 1917.

	1916.	1917.
January	1,849	2,350
February	1,287	2,109
March	481	1,099
April	103	422
May	68	95
June	129	111

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* Annual Report of the Sanitary Commissioner for the Madras Presidency for 1915, by Major W. A. Justice, I.M.S.

	1916.	1917.
July - - - - - -	335	417
August - - - - - -	585	882
September - - - - - -	1,119	2,303
October - - - - - -	1,317	4,688
November - - - - - -	1,657	5,483
December - - - - - -	2,568	4,749
Total - - - -	11,498	24,708

Deaths from plague were reported in 1,448 towns and villages during 1917, as compared with 848 in 1916. The plague death-rate was highest during 1917 in the Bellary district, namely, 12·5, the next being Anantapur with a rate of 3·4, as against 0·6 for the whole Presidency. Six of the 25 districts comprised within the province remained completely free from plague during the year; in six other districts there were only 18 cases, all imported instances. Only five deaths from plague were recorded in the city of Madras. According to the Sanitary Commissioner* the plague notification system which was in force during 1917 was abolished in 1918, as the result of a conference held at Madras in April, 1918. The system was found to be "too complicated and cumbrous to be workable except at a prohibitive cost." Attention is now concentrated upon known preventive measures, the chief of which is rat-destruction. Although the number of persons who submitted to anti-plague inoculation is not given, it is stated that 89 such persons died from the disease during 1917, against 85 in 1916.

The next table shows year by year the incidence of plague in the Madras Presidency from 1898 to 1917; also the case mortality-rate and the plague death-rate per 1,000 of the population.

Plague in the Madras Presidency 1898 *to* 1917.

Year.	Cases.	Deaths.	Case Mortality per cent.	Plague Death-rate per 1,000 of the Population.
1898 - - -	711	577	81·2	—
1899 - - -	2,480	1,855	74·8	—
1900 - - -	915	685	74·9	0·02
1901 - - -	3,686	3,035	82·3	0·10
1902 - - -	15,425	12,603	81·7	0·3
1903 - - -	16,853	13,291	78·9	0·4
1904 - - -	29,990	20,129	67·1	0·5

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* Annual Report for 1917 of the Sanitary Commissioner with the Government of Madras, by Major W. A. Justice, I.M.S.

Year.	Cases.	Deaths.	Case Mortality per cent.	Plague Death-rate per 1,000 of the Population.
1905 - - -	7,983	5,788	72·5	0·2
1906 - - -	1,334	898	67·3	0·02
1907 - - -	3.687	2,873	77·9	0·1
1908 - - -	5,031	3,358	66·7	0·1
1909 - - -	5,192	3,844	74·0	0·1
1910 - - -	6,361	4,867	76·5	0·1
1911 - - -	18,133	15,185	83·7	0·4
1912 - - -	8,895	7,107	79·9	0·2
1913 - - -	6,311	5,130	81·3	0·1
1914 - - -	7,523	5.102	67·8	0·1
1915 - - -	5,197	3.889	74·8	0·1
1916 - - -	15,916	11,498	72·2	0·3
1917 - - -	29,840	24,708	82·8	0·6
Total for 20 years	191,463	146,422	76·5	

During the first half of 1918, according to the monthly mortality returns, 10,417 deaths from plague occurred in the Presidency.

Bengal.

This province has a population of 45,329,247, and in it during 1914 only 554 deaths from plague were recorded, compared with 984 in 1913 and 1,995 in 1912, the death-rates from the disease in these three years being respectively 0·01, 0·02 and 0·04 per 1,000 living. Of the total 554 fatal plague cases, 442 occurred in the city of Calcutta, and 89 others were referred to the two suburban districts of 24-Parganas and Howrah. So that, apart from the municipal area, there was very little plague in the province. Of the 27 districts included in Bengal, there was not a single death from plague in 19 of them; one district had two cases, three districts had each one fatal case and one district, Hooghly, 18; so that, apart from Calcutta and the two suburban districts just mentioned, there were only 23 plague deaths in the whole province.

There was very little plague in Bengal during 1915, altogether 199 deaths from it being recorded, of which number 191 occurred in the city of Calcutta; so that outside the municipal boundary there were only 8 deaths from plague in the province during the year, four of which occurred in the district of Birbhum, two in 24-Parganas, and one each in Burdwan and Howrah.*

Plague inoculation was not carried out in Bengal during 1915, but rat destruction was continued, especially in Calcutta.

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* Annual Report on the Sanitation of Bengal for 1915, by Dr. Chas. A. Bentley, Sanitary Commissioner.

In 1916 there were only 110 deaths from plague recorded in Bengal. Of these, 78 or 71 per cent. occurred in Calcutta, 22 in the Birbhum district, four in Howrah, three in 24-Parganas and one each in Burdwan, Murshidabad and Rangpur. The 22 deaths in Birbhum occurred in a localised outbreak in Synthia, a village on the East Indian Railway Loop Line, the infection having been introduced by some Marwari traders.*

During 1917, according to the returns, there were 163 deaths from plague in Bengal, 81 of which occurred in Calcutta, 48 in the 24-Parganas district, 24 in Hooghly and 10 in Howrah; the rest of the province remained quite free from the disease. All the victims were residents in towns, none of the rural districts being affected. No plague inoculations were performed outside Calcutta. The campaign against rats was continued, about 65,000 being destroyed. Payment for destruction of rats was discontinued from 1st September 1917.

As Bengal was reconstituted as a province in 1912 and its area considerably altered, comparison of plague mortality in the present area is hardly permissible, but the figures for the six years ended 31st December 1917 are given in the following table:—

Deaths from Plague in Bengal 1912 *to* 1917.

Year.	Plague Deaths.	Death-rate from Plague per 1,000 of the Population.
1912	1,995	0·04
1913	984	0·02
1914	554	0·01
1915	199	0·004
1916	110	0·002
1917	163	0·003

The population of Bengal at the last census was 45,329,247 (excluding the Chittagong Hill Tracts, in which the system of registration of vital statistics has not yet been introduced).

During the first half of 1918 only 79 deaths from plague were registered in Bengal, outside the city of Calcutta, in which 187 fatal cases were recorded, making a total of 266 for the six months.

Calcutta (population, 1911 census, 896,071).—The annual outbreak of plague in Calcutta in 1914 was of a comparatively mild character, for only 451 cases and 442 deaths were recorded, against 886 cases and 852 deaths in 1913. The progress of the plague prevalence in Calcutta, month by month, during 1914 is seen in the appended table :—

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* Annual Report for 1916 on the Sanitation of Bengal by Dr. Chas. A. Bentley, Sanitary Commissioner.

1914.	Plague Cases.	Plague Deaths.
January	1	—
February	22	21
March	78	77
April	141	136
May	112	111
June	61	57
July	24	28
August	8	8
September	3	3
October	1	1
November	—	—
December	—	—
Total	451	442

The case mortality calculated on these figures is 98 per cent.; obviously, cases of plague of the milder kind have not been reported. The opinion of the Calcutta Health Officer is that the case mortality-rate was probably about 75 per cent..

Prophylactic inoculation has practically ceased, for only one person was inoculated in Calcutta during the year 1914. The destruction of rats, however, continues to be carried out and 155,774 were accounted for in 1914, against 233,032 in the previous year. A reward was paid, as before, to rat-catchers, the total sum disbursed for this purpose in 1914 being 2,553 rupees. Dr. H. M. Crake, the Health Officer for the city, has formed the opinion that rat destruction may be abolished for the following reasons :—(1) the vast majority of rats are caught in a few "dal" go-downs, which simply swarm with these rodents—in fact, the supply seems inexhaustible; (2) there is absolutely no relation between the incidence of plague in a given district and the number of rats caught; (3) there seems no doubt that the epidemic of plague is disappearing spontaneously.*

Seven of the cases in 1914 were imported, and for the first time no cases of the pneumonic type were reported.

In 1915 the number of plague cases and deaths showed a very great diminution, for only 204 cases and 191 deaths were recorded in Calcutta during the year. This is the smallest amount recorded in any year since 1898, when 238 cases and 192 deaths occurred.

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* Report of the Health Officer of Calcutta for the Year 1914, by Dr. H. M. Crake, Health Officer.

The distribution of the plague attacks and deaths in Calcutta during 1915 is shown, month by month, in the appended table :—

1915.	Plague Cases.	Plague Deaths.
January	3	3
February	3	3
March	25	22
April	116	110
May	44	42
June	8	6
July	4	4
August	—	—
September	—	—
October	—	—
November	1	1
December	—	—
Total	204	191

140 of the deaths occurred among males and 51 among females.

During 1915, 65,000 dead rats were removed from the streets, more than half of them during the first three months of the year. In addition, 130,953 more rats were killed in the city, and for these the sum of 2,046 rupees was paid.

In 1916 plague diminished in Calcutta, only 82 cases being reported, of which 78 or 95·1 per cent. died. These figures are the lowest on record since plague first appeared in the city in 1898. 71 of the plague victims were Hindus and only four Mahommedans, three belonging to other classes: 61 of the deaths were males and 17 females. As in 1915, half of the total number of those attacked by plague were persons between the ages of 10 and 30 years. The mortality in rats was less, 50,000 being reported against 65,000 in the previous year. Close upon 139,000 other rats were killed and the sum of 2,140 rupees was paid as a reward to the rat-catchers.*

The progress of the 1916 prevalence, month by month, is shown in the next table :—

1916.	Plague Cases.	Plague Deaths.
January	2	1
February	3	3
March	14	14
April	33	32
May	21	21
June	6	5
July	3	2
August	—	—

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* Report of the Health Officer of Calcutta for 1916, by Dr. H. M. Crake.

1916.	Plague Cases.	Plague Deaths.
September	—	—
October	—	—
November	—	—
December	—	—
Total	82	78

In 1917 the provisional returns for the year show that in Calcutta 87 persons were attacked by plague, and 81 of them died.

1917.	Plague Cases.	Plague Deaths
January	—	—
February	—	—
March	18	16
April	26	24
May	25	26
June	10	8
July	5	4
August	—	—
September	3	3
October	—	—
November	—	—
December	—	—
Total	87	81

During the year 64,489 rats were killed in Calcutta and 40,644 were found dead. The campaign against rats was abandoned on 1st September 1917, with the approval of the Corporation, on the ground that it was futile.

Altogether since 1898 to the end of 1917 67,883 cases of plague and 62,898 deaths have been reported in the city of Calcutta.

The following table shows the incidence of plague during these 20 years in Calcutta :—

Year.	Plague		Case Mortality per cent.	Plague Death-rate per 1,000 of the Population
	Cases.	Deaths.		
1898	238	192	80·7	...
1899	3,005	2,332	77·6	--
1900	8,822	8,354	94·7	—
1901	8,611	7,883	91·5	9·2

Year.	Plague		Case Mortality per cent.	Plague Death-rate per 1,000 of the Population
	Cases.	Deaths.		
1902 - - -	7,789	7,287	93·5	8·5
1903 - - -	8,891	8,222	92·5	9·6
1904 - - -	4,995	4,689	93·9	5·5
1905 - - -	7,993	7,372	92·2	8·7
1906 - - -	2,784	2,606	93·6	3·0
1907 - - -	3,820	3,592	94·0	4·2
1908 - - -	1,861	1,779	95·6	2·1
1909 - - -	2,251	2,117	94·0	2·5
1910 - - -	1,324	1,262	95·3	1·5
1911 - - -	1.851	1,736	93·8	1·9
1912 - - -	1.938	1,831	94·5	2·0
1913 - - -	886	852	96·2	0·9
1914 - - -	451	442	98·0	0·4
1915 - - -	204	191	93·6	0·02
1916 - - -	82	78	95·1	0·08
1917 - - -	87	81	93·1	0·09
	67,883	62,898	92·6	—

From this table it will be seen that the plague returns for 1916 were the lowest that had been recorded in Calcutta since 1898, when the disease first invaded the city.

Up to 1910 the measures for controlling plague in Calcutta were not in the hands of the Executive Health Officer, but were administered separately by a special department. In 1910 the Departments were amalgamated and plague control afterwards continued to be under the supervision of the Medical Officer of Health for the city.

At the census of 1911 the population of Calcutta along with its suburbs amounted to 1.043.307; but excluding the suburbs the population was 896,017.

Bihar and Orissa.

There was a considerable increase in the mortality from plague in Bihar and Orissa during 1914 as compared with the previous year, the deaths having risen from 36,383 in 1913 to 64,334 in 1914, the death rate from the disease in the province being 1·8 per 1,000 living, against a rate of 1·0 in the previous year and 1·6 the average of the 10 years 1904 to 1913. The district of Surah suffered the most during 1914, 20,389 deaths from plague being referred to it, giving a death-rate from the disease of 8·9 per 1,000; Shahabad came next with 12,880 deaths and a plague death-rate of 6·9; while Patna was third with 10,914 fatal cases and a plague death-rate of 6·7 per 1,000 of the population.

The distribution of the deaths from plague throughout the months of the year in the province of Bihar and Orissa is shown in the following table :—

1914.	Plague Deaths.
January	9,228
February	12,208
March	24,846
April	11,637
May	3,138
June	584
July	106
August	68
September	90
October	260
November	389
December	1,780
Total	64,334

It is obvious from this table that the plague prevalence of 1914 was most severe in the first half of the year, in which 61,641 deaths occurred, with only 2,693 in the second half.

Of the total deaths from plague, 27,041 were males and 37,293 females. It may be explained in this connection that at the census of 1911 the population of the province comprised 16,859,905 males and 17,630,038 females, the total population being 34,489,943.

During 1914, 24,330 persons were inoculated with Haffkine's prophylactic fluid, against 11,538 in 1913 and 9,838 in 1912. Schemes for systematically destroying rats in several of the towns were carried out.*

During 1915 plague continued to be prevalent in Bihar and Orissa, 27,241 deaths being recorded, a considerable reduction, however, upon the number reported in the previous year.

The distribution of these deaths, month by month, in 1915 is shown in the subjoined table :—

1915.	Plague Deaths.
January	2,196
February	4,802
March	9,928
April	6,629
May	1,398
June	99
July	15
August	50

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* Annual Sanitary Report of the Province of Bihar and Orissa for 1914, by Lieut.-Colonel E. C. Hare, I.M.S., Sanitary Commissioner.

1915.	Plague Deaths.
September	136
October	106
November	416
December	1,466
Total in 1915	27,241

Of these fatal cases, 11,702 were males and 15,539 females. The plague death-rate for the province was 0·7 per 1,000 of the population, compared with 1·8 in 1914, and a mean of 1·0 for the previous five years. The largest number of deaths occurred in the district of Surah (7,470) and Patna (7,291), the mortality rate for the latter being 4·5 and for the former 3·2. Only 10,835 persons submitted to prophylactic inoculation against plague during 1915, as compared with 24,330 in 1914, the operation not being at all popular with the native population of this province. Rat destruction was carried out in certain local areas for a time, but it was found, according to the Sanitary Commissioner's report*, that "such a scheme, unless undertaken on a colossal scale, was not likely to be of any real or permanent value"; it was therefore abandoned.

During 1916 there were 25,349 deaths from plague in this province, the death-rate from the disease being 0·7. The course of this prevalence, as shown by the number of deaths, is given in the subjoined table :—

Deaths from Plague in Bihar and Orissa in 1916.

1916.	Plague Deaths.
January	3,085
February	5,422
March	9,234
April	3,028
May	537
June	17
July	112
August	281
September	143
October	293
November	739
December	2,458
Total	25,349

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[*] Annual Sanitary Report of the Province of Bihar and Orissa for the Year 1915, by Major W. C Ross, I.M.S., Officiating Sanitary Commissioner.

Of these fatal cases, 10,798 were males and 14,551 females. The districts that suffered chiefly were Patna with 6,397 deaths and a plague death-rate of 3·9 per 1,000, Surah with 6,696 deaths and a rate of 2·9, and Shahabad with 4,146 deaths and a rate of 2·20. Ten out of the 21 districts comprised within the province escaped entirely from plague during 1916. In the opinion of the Officiating Sanitary Commissioner, "the disease has not shown any tendency to spread outside the endemic area and it appears to be slowly diminishing in virulence and in prevalence."* Only 6,021 anti-plague prophylactic inoculations were done during 1916. This measure has never been popular in Bihar and Orissa.

The maintenance of a special staff for rat destruction was discontinued during the year, except in Bhagalpur, where, the Officiating Sanitary Commissioner states, the results were unsatisfactory. In reviewing the plague situation in the province, Major W. C. Ross, I.M.S., says he is compelled to draw the conclusion from his experience that "outside interference can accomplish little when it is opposed by the inertia and the prejudices of the people, who dislike inoculation and will not take the trouble to get rid of rats in their own houses." He goes on to say that, in his opinion, the only plague preventive measure which has any practical value at present is evacuation and the value that lies in its acceptance by the people who understand its benefits and carry it out promptly.

During 1917 the number of deaths from plague rose to 45,436, as compared with 25,349 in 1916 and 27,241 in 1915.

The course of the 1917 prevalence is shown, month by month in the following table :—

Deaths from Plague in Bihar and Orissa in 1917.

1917.	Plague Deaths.
January	3,728
February	7,333
March	11,680
April	9,259
May	2,631
June	540
July	429
August	440
September	333
October	690
November	1,901
December	6,472
Total	45,436

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* Annual Sanitary Report of the Province of Bihar and Orissa for the Year 1916 by Major W. C. Ross, I.M.S., Officiating Sanitary Commissioner.

Of these deaths, 19,446 were men and 25,990 women.

The districts which yielded the highest plague mortality during the year were Shahabad, with 10,089 deaths and a mortality-rate of 6·1 per 1,000; Patna, with 8,121 deaths and a rate of 5; and Surah, with 8,953 fatal cases and a rate of 3·9. The unusually prolonged rains created favourable conditions for the continuance of plague in this province. Inoculation against plague was received by 11,445 persons; but this measure has never been popular with the people, and the maintenance of a special staff for the purpose has now been discontinued, as also has been the special staff for rat destruction. The Sanitary Commissioner, Major W. C. Ross, in his annual report for 1917 repeats the opinion expressed in 1916, namely, that outside interference can accomplish little when it is opposed by the inertia and the prejudices of the people, who will not take the trouble to get rid of rats. In his opinion, the only plague preventive measure which has any practical value at present is evacuation, and the value of this measure lies in its general acceptance by the people who understand its benefits and who carry it out promptly.

The new province of Bihar and Orissa was constituted in 1912, so that comparison of the incidence of plague in the same area is not practicable. The progress of fatal plague in the province from 1912 to 1917 is shown in the next table:—

Year.	Deaths from Plague.	Plague Death-rate per 1,000 of the Population.
1912 - - -	58,324	1·4
1913 - - -	36,383	1·0
1914 - - -	64,334	1·8
1915 - - -	27,241	0·7
1916 - - -	25,349	0·7
1917 - - -	45,436	1·3

At the census of 1911 the population of Bihar and Orissa as now constituted was 38,435,293, of which 3,945,209 belonged to Native States.

During the first half of 1918 the deaths reported from plague in this province numbered 34,026.

The United Provinces of Agra and Oudh.

The number of deaths ascribed to plague in the United Provinces of Agra and Oudh during 1914 was 103,954, as compared with 107,683 in the preceding year, the death-rate from the disease in these years being respectively 2·22 and 2·30 per 1,000 living, against an average of 3·19 for the previous five years. According to the weekly preliminary statements of plague seizures in India the number of reported attacks in the

United Provinces during 1914 was 110,665, and assuming that this is approximately correct the case mortality-rate would be 93·5 per cent. This high case mortality-rate suggests, however, that the number of attacks must have been greater than that given in the weekly returns. The monthly incidence of reported plague deaths follows the usual seasonal curve, being highest in the early months of the year, dwindling down in the summer, and rising again towards the end of the year. This can be seen in the table below, which gives the deaths month by month in the United Provinces :—

Plague in the United Provinces in 1914.

1914.	Plague Deaths.
January	16,719
February	21,613
March	33,814
April	19,806
May	5,765
June	628
July	47
August	114
September	164
October	276
November	1,295
December	3,713
Total	103,954

Of these fatal cases, 47,446 were males and 56,508 females. The districts in which the greatest number of deaths from plague occurred during 1914 were Ballia (with 22,154 deaths), Azamgarh (15,694), Gorakhpur (12,865), and Ghazipur (12,561).*

During the year 81,302 persons were inoculated with Haffkine's prophylactic, 48,051 being done by the officers of the travelling dispensaries and 33,251 by the ordinary and special medical staff. The data as to the latter only are available, and it appears that of these inoculated persons 21 are said to have died of plague at a later period. No details are given, but it is well known that much difficulty is experienced in obtaining trustworthy information concerning these alleged cases.

In 1915 the number of plague deaths reported in the United Provinces fell to 58,128, and these were distributed over the months of the year as follows :—

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* Annual Report of the Sanitary Commissioner of the United Provinces of Agra and Oudh for 1914, by Lieut.-Colonel S. A. Harriss, I.M.S., Sanitary Commissioner.

Plague in the United Provinces in 1915.

1915.	Plague Deaths.
January	4,889
February	9,548
March	17,797
April	16,607
May	3,749
June	134
July	30
August	65
September	191
October	340
November	1,116
December	3,662
Total	58,128

Of these fatal cases, 25,874 were males and 32,254 females. The plague mortality-rate for 1915 in the United Provinces was 1·24 per 1,000 of the population, the mean of the previous five years being 3·47. The District of Azamgarh was again among the chief sufferers, having 11,206 deaths, giving a plague mortality-rate of 7·51 per 1,000. Ghazipur came next with 6,269 deaths, the death-rate from plague being 7·46. Ballia was third, with 5,586 deaths and a rate of 6·61. Only 45,561 persons submitted themselves to anti-plague inoculation against 81,302 in 1914. Of the 45,561 inoculated persons in 1915, 19 are reported to have subsequently died of plague, but it is admitted that the information about them is not trustworthy, the true facts being difficult to obtain.*

During 1916 the deaths from plague in the United Provinces declined to 49,368, giving a death-rate of 1·05 per 1,000 of the population. The number of deaths from the disease has been less each succeeding year since 1911. The prevalence of plague in 1916 reached its maximum during the month of March and its minimum in July. Ballia was the district that suffered most, the fatal cases amounting to 7,444, giving a plague mortality-rate of 8·80 per 1,000 living; Gorakhpur had 7,403 deaths, Azamgarh, 6,323; and Ghazipur, 6,247. Of the 48 districts comprised in the United Provinces, seven remained quite free from plague during the year, and in eight others the number of deaths from the disease did not exceed five.

The number of person who submitted to inoculation during 1916 was 44,680; 19,249 of whom were referred to Ballia and 9,921 to Gorakhpur. Twelve persons are said to have died from plague subsequently, but details of these cases are not obtainable. Of the total 49,368 plague deaths, 21,801 were males and 27,567 females. The following table shows, month by month, the progress of the prevalence of plague during 1916 :—

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* Annual Report of the Sanitary Commissioner for the United Provinces of Agra and Oudh for 1915, by Lieut.-Colonel S. A. Harriss, I.M.S.

Plague in the United Provinces in 1916.

1916.	Plague Deaths.
January	7,048
February	9,521
March	16,440
April	6,023
May	1,036
June	56
July	111
August	405
September	390
October	564
November	1,698
December	6,076
Total	49,368

The increase of plague deaths observed in the two last months of 1916 was continued during the earlier months of 1917, and that year showed a considerable rise in the recorded mortality from the disease, the deaths for 1917 amounting to 129,084. The progress of the fatal incidence of plague in the United Provinces during the year is shown, month by month, in the following table :—

Plague in the United Provinces in 1917.

1917.	Plague Deaths.
January	11,212
February	21,248
March	30,528
April	22,366
May	8,542
June	1,940
July	669
August	1,305
September	934
October	1,917
November	6,500
December	21,923
Total	129,084

Of these fatal cases 56,663 were males and 72,421 females. The increased number of deaths in December is usually an indication of greater prevalence of the disease in the succeeding early months of the next year. So that the prospect was unfavourable for 1918. The maximum monthly mortality from this disease was reached in 1917, as usual, in March.

Of the districts affected by plague in 1917 Ghazipur headed the list with a plague death-rate of 17·8; Ballia coming next with a rate of 15·7; and Azamgarh with 11·57; the death-rate from plague in the United Provinces as a whole was 2·76. Inoculation and evacuation were chiefly relied upon to control the disease. In the Azamgarh district destruction of rats by barium carbonate was being tried; 81,126 persons were inoculated during the year, of whom 11 are said to have died of plague. In addition to the 129,084 plague deaths in 1917 there were 3,304 others among the population of the Native States comprised within the boundaries of the United Provinces.

Plague has been present in the United Provinces since 1897, that is, for the past 21 years, during which the disease has carried off 2,201,811 victims.

The subjoined table gives the number of plague deaths recorded year by year, 1897 to 1917:—

Deaths from Plague in the United Provinces, 1897 *to* 1917.

Year.	Plague Deaths.	Death-rate per 1,000 of the Population.
1897	89	—
1898	148	—
1899	7	—
1900	135	—
1901	9,778	0·20
1902	43,487	0·84
1903	80,729	1·77
1904	179,082	3·75
1905	383,834	7·72
1906	69,660	1·46
1907	329,047	6·90
1908	22,881	0·48
1909	38,397	0·80
1910	158,074	3·31
1911	323,301	7·09
1912	114,945	2·45
1913	107,683	2·30
1914	103,954	2·22
1915	58,128	1·24
1916	49,368	1·05
1917	129,084	2·76
Total in 21 years	2,201,811	—

The population of the United Provinces of Agra and Oudh at the 1911 census was 47,182,044.

There appears to be no sign as yet that plague is diminishing in the United Provinces; during the first six months of 1918 no fewer than 136,712 deaths were returned from this cause, a number higher than in any completed year since 1911.

The Punjab.

As has been mentioned in previous reports, the Punjab has been one of the Indian provinces that has suffered most from the ravages of plague during recent years. In 1914 the number of deaths recorded from the disease was 73,627, as compared with 20,231 in 1913 and 35,471 in 1912. The deaths recorded since 1897 from plague in the Punjab amounted, up to the end of 1914, to the appalling total of 2,604,873, in a population of 24,187,750 (according to the census of 1911). The height of the prevalence in 1914 was reached in April, in which month alone 21,358 fatal cases were reported. The table below gives the number of attacks and deaths from plague recorded, month by month, in the province during 1914 :—

Plague in the Punjab in 1914.

1914.	Cases.	Deaths.
January - - - -	2,098	1,640
February - - - -	4,399	3,602
March - - - - -	12,542	10,257
April - - - - -	26,324	21,358
May - - - - -	20,857	18,862
June - - - - -	4,338	4,075
July - - - - -	217	221
August - - - -	333	231
September - - - -	307	246
October - - - -	1,088	676
November - - - -	4,323	3,260
December - - - -	11,279	9,199
	88,105	73,627

Of the above, 76,269 cases and 64,077 deaths were referred to the British districts, and 11,836 attacks with 9,550 deaths to the native states of the province, among which the chief sufferer was Patiala with 6,845 cases and 6,477 deaths. The British district which had the highest number of attacks was Gujranwala (the population of which in 1911 was 923,419), where 15,176 cases and 14,766 deaths were recorded. The case mortality-rate for the whole province was 83·6 per cent.; in the British districts, 84, and in the Native States, 80·7.

From the table above it will be seen that the incidence of plague was increasing towards the end of 1914, and, from reports which have been subsequently received, this increase continued at a somewhat rapid rate during the earlier months of 1915 as will be seen further on.

The increased fatal prevalence of the disease has been attributed by Lieut.-Colonel D. T. Lane, I.M.S., Chief Plague Medical Officer for the Province, to the late monsoon of 1914 having favoured the conditions, such as flea-breeding, which promote plague, and with the result that "a large legacy of plague infection was transmitted to 1915." This expert recommends that the anti-plague measures should be begun in the quiescent period, which begins in July, when the disease is less prevalent and the preventive action can be undertaken with greater certainty of success. On the whole the attitude of the natives of the Punjab towards the anti-plague measures is becoming more reasonable, though it varies from time to time. When plague is epidemic and there is obvious danger, the people readily accept assistance, and co-operate with the medical officers; but when there is no apparent danger they sink back into apathy and do not trouble themselves to carry out the measures recommended. The population nevertheless display more confidence now in the staff employed in plague prevention, and are working more in harmony with them than in previous years. Colonel Lane remarks that it is very regrettable that the people in the quiescent season are so careless and apathetic for "if each householder kept his house free from rats there would be no more plague." He estimates that there are 15 millions of rat holes in the 21 infected districts of the Punjab; and unless each householder does his share it is impossible for the special staff to make any progress in this life-saving measure.

As regards the *destruction of rats* by baiting, "smoking," and trapping, much was done by some municipalities, but in others this work has not been thoroughly carried out. Some 49,468 people submitted to *inoculation* by Haffkine's method, as compared with 26,419 in the previous year. In addition to the special plague staff, 200 dispensaries are equipped for anti-plague inoculation. With respect to *evacuation*, the people vacate their houses generally when plague is very severe, and sometimes in panic when the disease is not serious. *Disinfection* of clothing by exposure to the sun, and burning of cow-dung cakes or leaves on the floors of houses, is sometimes carried out.

Hitherto the efforts to educate the people in preventive measures have been almost entirely confined to men. But as Colonel Lane points out, plague is a disease of the home and prevention is largely a matter of keeping a house clean, so that the education of women in such measures is very necessary. Once they understand that rat holes and unswept floors endanger the lives of their husbands and their children they will do their duty.*

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* Report on the Sanitary Administration of the Punjab for the year 1914, by Colonel C. J. Bamber, M.V.O., I.M.S., Officiating Sanitary Commissioner.

During 1915 plague again became very seriously epidemic in the Punjab—worse, indeed, than in any of the seven preceding years. The total attacks recorded reached the high number of 293,750, and of these no fewer than 244,104 had a fatal termination. Calculated on these figures, the fatality-rate was 83·1 per cent. In the British districts 264,871 of the cases were recorded with 222,080 deaths; and in the Native States, 28,879 attacks and 22,024 deaths. The height of the 1915 epidemic was attained in April, in which month more than 88,000 persons lost their lives from plague, and by August the disease had almost disappeared. The course of the epidemic will be seen in the subjoined table :—

Plague in the Punjab in 1915.

1915.	Cases.	Deaths.
January	18,723	15,318
February	34,859	29,663
March	69,974	55,509
April	106,455	88,428
May	57,517	50,400
June	5,036	3,981
July	505	334
August	47	28
September	21	16
October	79	44
November	246	166
December	288	217
	293,750	244,104

Of 221,966 deaths from plague mentioned in a report and which were referred to the British districts of the Punjab, 108,320 were males and 113,646 females. The plague death-rate in these British districts was 11·48 per 1,000 of the population, the mean rate of the previous five years being 4·33.

The districts which suffered most in 1915 were the following :—

District.	Population (1911).	Deaths from Plague.	Mortality-rate from Plague per 1,000 of the Population.
Gujrat	702,886	26,869	36·04
Sialkot	855,399	21,970	22·81
Jallundur	691,816	17,698	22·46
Amritsar	711,530	17,620	20·04
Gurdaspur	784,343	17,334	20·[illegible]2
Gujranwala	838,879	17,098	18·52

The largest number of cases and deaths in the Native States occurred in Patiala, in which 17,396 persons were attacked, of whom 14,757 died; and Karpurthala, in which there were 5,434 plague attacks and 3,422 deaths.

During the year, 166,157 persons were inoculated against plague, of whom 4,844 were in the Native States and 161,313 in the British districts. The other preventive measures employed were the same as in the previous year. The special staff for plague duty in the Punjab during the year included 30 assistant surgeons and seven sub-assistant surgeons; and with regard to the auxiliary staff all assistant surgeons and sub-assistant surgeons in charge of dispensaries are now required to attend to outbreaks of plague in towns and villages pending the arrival of the special staff.*

The year 1916 showed a remarkable diminution in the incidence of plague in the Punjab, for only 5,272 cases and 4,151 deaths were reported, as compared with 293,750 attacks and 244,104 deaths in the previous year. Of the 4,151 deaths, 3,325 occurred in British districts and 826 in Native States. This was the mildest prevalence of plague that the Punjab has experienced since the disease established itself in the province. The Ambala district had the largest number of deaths, namely, 1,412. Of the Native States, Patiala had the most plague, 604 fatal cases being recorded. The course of the prevalence of plague in the Punjab during 1916 is shown in the subjoined table :—

Plague in the Punjab in 1916.

1916.	Cases.	Deaths.
January - - - - -	375	313
February - - - - -	671	477
March - - - - -	1,304	1,080
April - - - - -	1,427	1,176
May - - - - -	375	291
June - - - - -	62	63
July - - - - -	2	2
August - - - -	16	11
September - - - - -	193	128
October - - - -	353	273
November - - - - -	291	213
December - - - -	203	124
Total - - -	5,272	4,151

Calculated on the above figures the case mortality-rate was 78·7 per cent.

In the infected villages during the prevalence and in the late infected villages during the quiescent period of the disease, the destruction of rats was actively carried out by means of trapping, smoking, &c., as far as was possible with a reduced staff. Houses were also fumigated with cresol to destroy fleas; evacuation and inoculation also were practised with some success. The number of persons who submitted to inoculation during 1916 was 19,886.*

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* Annual Report on Sanitary Administration in the Punjab for 1915, by Colonel H. Hendley, Officiating Sanitary Commissioner.

During 1917, 14,009 cases and 9,724 deaths from plague were reported in the Punjab, 13,225 of the cases and 9,031 of the deaths being referred to the British districts, and 784 attacks with 693 deaths to the Native States of the province. The course of the 1917 plague prevalence is shown, month by month, in the following table :—

Plague in the Punjab in 1917.

1917.	Cases.	Deaths.
January	276	193
February	507	340
March	951	628
April	1,701	1,090
May	2,229	1,562
June	1,202	821
July	156	115
August	149	87
September	324	225
October	886	579
November	2,041	1,350
December	3,587	2,734
	14,009	9,724

Nearly half of the total deaths from plague during 1917 occurred in the two last months of the year, and this generally means an increased prevalence in the succeeding months of the next year. According to the monthly mortality returns for the first half of 1918, more than 94,000 deaths were recorded from plague in the Punjab. The British districts which had the largest number of plague deaths during 1917 were Lahore (with 2,066 fatal cases), Rawalpindi (with 1,746), and Ambala (with 1,427). Of the Native States, Patiala headed the list with 411 fatal cases. The seasonal distribution was rather unusual. Generally there is in this province a gradual rise from January to April, and then an abrupt fall; but in 1917 the rise extended into May and June, the marked fall not being evident until July. This change was associated, according to the Sanitary

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* Annual Report on the Sanitary Administration of the Punjab for 1916, by Colonel H. Hendley, K.H.S., I.M.S., Sanitary Commissioner.

Commissioner,* with the unusual rainfall in the late spring. The preventive measures relied upon were :—

(*a*) destruction of rats by means of traps, poison and smoke apparatus—concentrated round infected areas and infected places during epidemics and in selected late-infected villages during the off-season;

(*b*) cresol fumigation and inoculation where possible, and

(*c*) evacuation, in some districts.

Barium carbonate was used as a rat poison with satisfactory results. In all, 19,400 inoculations were performed. The attitude of the people to inoculation varies in different districts, but it is more generally accepted than before.

The remarkable drop in the number of plague deaths in this province in the year 1916, only 4,151 being recorded against 244,104 in 1915, is not easily explained: and though, in 1917, the number of fatal cases increased to 9,724, this was very much less than had been reported in any of the preceding 15 years, except 1916. Various suggestions were put forward at the time, and it was believed that at last the many preventive measures that had been so energetically employed during previous years were bearing fruit. But the later experience of the first half of 1918 does not support this view. It was also suggested that the war conditions had indirectly affected the plague mortality, by creating a great demand for cereals, the price of which was considerably raised. This led to the cultivators of the soil selling out their stores of grain in order to make the high profit offered. This had the effect of greatly reducing the amount of cereals stored in the villages and hamlets, and at the same time decreasing the food supply of the rats infesting the dwellings and storehouses, these animals being thus driven from the villages and hamlets into the fields to search for food. The diminution of the rats infesting the homes of the cultivators decreased the opportunities for spreading plague in these places. The suggestion likewise was put forward that Colonel Lane's recommendations—made in 1914 and already mentioned—that women should be instructed in the part they should play as regards the exclusion of rats from their homes, had had some effect in reducing the opportunities of rats to spread plague infection.

But, be this as it may, the fact remains that there was an extraordinary decline in the number of plague deaths in this province during 1916 and 1917; and this may be seen in the next table which gives, year by year, the number of cases and deaths reported in the Punjab from 1897 to 1917, a period of 21 years. Up to 1912 the figures in the table included plague attacks and deaths in the area which was separated in that year from the Punjab to form the new province of Delhi; the population thus taken from the Punjab in 1912 numbered 391,828. As has been said, the population of the Punjab at the last census was 24,187,750, including the Native States.

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* Annual Report on the Sanitary Administration of the Punjab for 1917, by Colonel H. Hendley, K.H.S., I.M.S.

Plague in the Punjab, 1897 *to* 1917.

Year.	Cases.	Deaths.	Case Mortality per cent.	Plague Death-rate per 1,000 of the Population.
1897 - - -	302	179	59·3	—
1898 - - -	3,135	2,019	64·4	0·06
1899 - - -	408	255	62·5	0·01
1900 - - -	882	572	64·8	0·03
1901 - - -	36,739	20,998	57·2	0·74
1902 - - -	321,938	222,571	69·1	8·52
1903 - - -	341,267	210,697	61·7	10·22
1904 - - -	481,412	402,950	83·7	19·71
1905 - - -	451,791	390,233	86·4	16·35
1906 - - -	120,745	104,863	86·8	4·56
1907 - - -	742,511	666,501	89·8	30·27
1908 - - -	48,065	40,106	83·4	1·53
1909 - - -	54,425	45,064	82·8	1·77
1910 - - -	201,016	169,867	84·5	6·74
1911 - - -	220,411	198,669	90·1	8·89
1912 - - -	42,414	35,471	83·6	1·52
1913 - - -	24,835	20,231	81·4	0·92
1914 - - -	88,105	73,627	83·6	3·31
1915 - - -	293,750	244,104	83·1	11·48
1916 - - -	5,272	4,151	78·7	0·17
1917 - - -	14,009	9,724	69·4	0·45
	3,493,432	2,862,852	82·0	—

Delhi.

The population of this small province at the 1911 census was 391,828 (232,837 being in the city of Delhi). It was constituted a separate administrative area on 1st October 1912. During that year, 97 deaths from plague were recorded and there were 249 cases and 199 deaths in 1913.

There was little recognised plague in the province of Delhi during 1914, only 26 cases and 13 deaths being recorded, all of them occurring during the first five months of the year. Only two of the deaths were referred to the city of Delhi itself. In the previous year, 249 persons were attacked by plague in this province, and 199 of them died.

In 1915 plague appeared in sporadic form, some 14 cases and 8 deaths coming under observation, all of them during the first five months of the year. Six of the fatal cases occurred in the city of Delhi.

In 1916 there were notified in the Province of Delhi 61 cases of plague with 34 deaths, 12 of which occurred in the city and 22 in the rural district. During 1917 the plague cases and deaths declined considerably, only four fatal cases being recorded, three of them in the city itself and one outside in the surrounding district.

According to the monthly reports of mortality in the Delhi province for the first half of 1918, there were, altogether, 187 fatal plague cases certified in the period, 91 being in the city and 96 in the rural area around the city.

Burma.

There was a considerable increase in the number of deaths attributed to plague during 1914 in the Province of Burma, 7,488 fatal cases being recorded, against 4,308 in 1913 and 3,014 in 1912. Of the total of 7,488, Lower Burma contributed 5,172 and Upper Burma 2,316. The largest number of deaths were recorded in the earlier months of the year, as may be seen in the following table, which distinguishes the plague deaths reported, month by month, in Lower and Upper Burma :—

Deaths from Plague in Burma in 1914.

1914.	Lower Burma.	Upper Burma.	The Province of Burma.
January - - -	627	650	1,277
February - - -	882	821	1,703
March - - - -	892	494	1,386
April - - - -	731	86	817
May - - - -	462	5	467
June - - - -	370	16	386
July - - - -	432	28	460
August - - -	283	40	323
September - - -	132	11	143
October - - -	95	17	112
November - - -	66	60	126
December - - -	200	88	288
Totals - -	5,172	2,316	7,488

The plague death-rate per 1,000 living in Lower Burma was 0·81, and in Upper Burma 0·67, the same rate for the whole province (which had a population of 12,115,217 at the census of 1911) was 0·76 per 1,000, the mean of the previous five years being 0·60. Of the 7,488 deaths from plague during the year, 4,297 were males and 3,191 females. The total number of plague attacks in the province reported up to the end of the year in the weekly returns was 8,167; and, if this be approximately correct, the case mortality-rate for 1914 would be 91·7 per cent.

The places which suffered most were Rangoon, with 1,585 fatal cases, and Mandalay which had 1,157. During the year 481,112 rats were destroyed, of which 416,640 were killed in Rangoon. The number of persons who received protection by inoculation with Haffkine's prophylactic was 47,574, of whom 7,216 were contributed by Rangoon and 12,765 by Mandalay. The operation was nowhere popular in Lower Burma. Evacuation of invaded houses was also carried out.*

During 1915 plague was still prevalent in Burma, though in less amount than in the previous year, the reported cases numbering 5,788 and the deaths 4,640, giving a case mortality-rate of 80·2 per cent.

The course of the fatal prevalence of plague in 1915 in Burma is shown, month by month, in the subjoined table:—

Deaths from Plague in Burma in 1915.

1915.	Lower Burma.	Upper Burma.	The Province of Burma.
January - - -	719	237	956
February - - -	674	407	1,081
March - - - -	377	210	587
April - - - -	196	84	280
May - - - -	192	4	196
June - - - -	175	5	180
July - - - -	197	24	221
August - -	132	31	163
September - -	65	14	79
October - - -	37	32	69
November - - -	42	156	198
December - - -	85	545	630
	2,891	1,749	4,640

The increase in the number of fatal cases towards the end of 1915 was the precursor of an epidemic in the early part of 1916, during the first three months of which at least 4,323 persons died of plague, or nearly as many as in the whole 12 months of 1915.

Plague in Burma is mainly prevalent in towns, thus in 1915 there were 3,711 deaths from the disease in the urban districts and only 929 occurred in the rural areas, the respective plague mortality-rates being 3·38 per 1,000 in towns and 0·11 in rural districts; the plague death-rate for the whole province being 0·47, the mean of the previous five years having been 0·60.

In Rangoon there were 590 cases and 571 deaths during 1915, and 635 deaths in Mandalay. At both of these ports plague was epidemic at the end of the year, continuing with great severity during the first quarter of 1916. At Rangoon, from 1st January to 22nd April 1916, no fewer than 1,113 persons died of plague, and at Mandalay 1,299 during the same period. At the town and port of Bassein, 337 plague deaths were recorded during 1915, but only 11 at Moulmein. The number of rats destroyed in Burma during the year was 477,250, of which 24,109 were killed in Upper Burma and 429,465 in Rangoon. As regards inoculation, altogether 39,990 persons submitted to the operation during the year, namely, 9,609 in Lower and 30,381 in Upper Burma. In Mandalay city 8,144 persons were inoculated and 4,022 in Rangoon.

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* Report on the Sanitary Administration of Burma for the year 1914, by Lieut.-Colonel C. E. Williams, I.M.S., Sanitary Commissioner.

The experience of the town of Sagaing (in Upper Burma) is worth mentioning. In anticipation of an epidemic, 9,500 of the inhabitants, out of a total population of 10,937, were inoculated in the short space of a month, at the beginning of the year and, although rats continued to die of plague all over the town, the disease was completely checked among the human population. Only three deaths from plague, all within 10 days of the inoculation, occurred among those who had been inoculated. The Commissioner of Sagaing, writing to the Sanitary Commissioner of the province, stated that "Saigaing has no fear of plague. Even if the rats and an occasional non-inoculated person die, yet the inoculated town goes about its business as if the plague did not exist at all."*

In the port of Rangoon, on "riverine" vessels, three plague cases occurred; 32 outgoing vessels were fumigated at the agents' request by means of the Clayton apparatus.†

During 1916 the total number of plague deaths recorded in Burma was 7,702, of which 5,658 were referred to Lower Burma and 2,044 to Upper Burma. The great majority of these deaths occurred in the towns, namely, 6,649 against 1,053 in the rural areas. At Rangoon the plague deaths in 1916 numbered 1,810, and 1,494 at Mandalay; 705 deaths from plague occurred at the Burmese port of Bassein. The plague mortality-rate per 1,000 of the population in Burma province during 1916 was 0·78.

Anti-plague inoculation was performed during the year on 63,458 persons; 436,218 rats were destroyed in the same period, and of these 385,161 were killed in Rangoon.‡

At this port four cases of plague arrived on incoming vessels and two on "riverine" craft. There were also six cases among the employees of the Rangoon Port Trust. Twenty-two vessels were fumigated in the port during the year for the destruction of rats at the request of the shipping agents. No case of plague occurred on board any ship that left the port during 1916.*

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* Report for 1915 on the Sanitary Administration of Burma, by Lieut.-Colonel C. E. Williams, I.M.S.

† Annual Report on the Health of the Port of Rangoon, by Dr. F. Arthur Foy.

‡ Report on the Sanitary Administration of Burma for 1916, by Lieut.-Colonel C. E. Williams, I.M.S., Sanitary Commissioner.

The seasonal incidence of plague in Burma during 1916 is shown in the following table :—

Deaths from Plague in Burma in 1916.

1916.	Lower Burma.	Upper Burma.	The Province of Burma.
January - - -	354	889	1,243
February - - -	902	688	1,590
March - - - -	1,173	300	1,473
April - - - -	754	51	805
May - - - -	362	8	370
June - - - -	488	—	488
July - - - -	638	—	638
August - - -	243	—	243
September - - -	175	4	179
October - - -	155	3	158
November - - -	96	8	104
December - - -	318	93	411
	5,658	2,044	7,702

During 1917 plague was again prevalent in Burma, though in slightly less amount than in 1916, 6,524 deaths being recorded, of which 4,645 were referred to Lower Burma and 1,879 to Upper Burma. The plague death-rate for the province was 0·66, the mean of the previous five years being 0·55. Of the total deaths from plague, 4,802 occurred in urban areas and 1,722 in rural districts. In one instance the infection was introduced into a town (Sagu) through dead rats, enclosed in boxes containing clothing, brought by a merchant from Rangoon, resulting in 76 deaths. In other instances the infection was brought to towns in boxes containing leather goods. In Rangoon 1,378 plague cases, 1,288 of them fatal, were reported during the year, giving a case mortality-rate of 93·4 per cent.; 81 deaths from plague in Bassein, 18 in Moulmein, and 854 in Mandalay were also reported. In all, 75,551 anti-plague inoculations were performed; 471,249 rats were destroyed, nearly six-sevenths of the total being accounted for in the Rangoon municipality.†

In Rangoon the greatest plague incidence was observed during the months of July, August and September; the age-period most attacked was that between 20 and 30 years. Of the total 1,378 plague cases in Rangoon during 1917, 1,198 were treated at home, and of these, 1,154, or 96·3 per cent., died; only 180 cases were treated in hospital, and of these, 134, or 74·4 per cent., died. Forty-two of the cases were imported instances. During the year, 12 plague cases were detected in the port, 4 of them in incoming vessels, 2 in "riverine" steamers, and 6 among employees of the Port Trust.*

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* Annual Report on the Health of the Port of Rangoon for 1916, by Dr. F. Arthur Foy.

† Annual Report on the Sanitary Administration of Burma for 1917, by Lieut.-Colonel C. E. Williams, I.M.S., Sanitary Commissioner.

The distribution of the deaths from plague in Burma during 1917 is shown in the following table :—

Deaths from Plague in Burma in 1917.

1917.	Lower Burma.	Upper Burma.	The Province of Burma.
January - - -	685	134	819
February - - -	882	217	1,099
March - - - -	744	102	846
April - - - -	381	11	392
May - - - -	235	3	238
June - - - -	344	5	349
July - - - -	522	12	534
August - - -	376	31	407
September - - -	201	71	272
October - - -	111	147	258
November - - -	68	278	346
December - - -	96	868	964
	4,645	1,879	6,524

Plague first appeared in Burma in 1899, but up to 1904 only sporadic cases came under notice. Since 1905 the disease has been present in the province in greater amount, and the subjoined table gives the number of plague deaths recorded year by year from 1899 to 1917, inclusive :—

Plague Deaths in Burma, 1899 *to* 1917.

Year.	Plague Deaths.	Plague Death-rate per 1,000 of the Population.
1899 - - -	2	—
1900 - - -	3	—
1901 - - -	3	—
1902 - - -	4	—
1903 - - -	9	—
1904 - - -	3	—
1905 - - -	3,692	0·55

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* Annual Report of the Port Health Officer, Rangoon, for 1917, by Dr. F. Arthur Foy

Year.	Plague Deaths.	Plague Death-rate Per 1,000 of the Population.
1906 - - -	8,637	1·02
1907 - - -	9,249	1·09
1908 - - -	6,752	0·79
1909 - - -	6,946	0·81
1910 - - -	7,741	0·91
1911 - - -	6,060	0·61
1912 - - -	3,014	0·31
1913 - - -	4,308	0·44
1914 - - -	7,488	0·76
1915 - - -	4,640	0·47
1916 - - -	7,702	0·78
1917 - - -	6,524	0·66
Total in 19 years	82,777	—

From January to June 1918, according to the monthly mortality returns, 7,047 deaths from plague were recorded.

The population of Burma at the 1911 Census was 12,115,217.

The Central Provinces and Berar.

From the Annual Report of Major T. S. N. Stokes, I.M.S., the Sanitary Commissioner, it appears that 896 persons died in the Central Provinces and Berar from plague during 1914, compared with 512 in 1913 and 19,199 in 1912. Almost all of the fatal cases in 1914 occurred in the last four months of the year, as will be seen in the table below :—

1914.	Plague Cases.	Plague Deaths.
January - - - - -	4	1
February - - -	7	5
March - - - - -	—	—
April - - - - -	—	—
May - - - - -	—	—
June - - - - -	—	—
July - - - - -	—	—
August - - - - -	7	6
September - - -	84	55
October - - - - -	234	198
November - - -	145	133
December - - -	587	498
Total - -	1,068*	896

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* The number of cases has been obtained from the weekly preliminary statements as to plague seizures in India.

Reckoned on these figures, the case mortality-rate was 83·9 per cent. Of the fatal cases, 469 were males and 427 females. The death-rate from plague in the Central Provinces for 1914 was 0·06 per 1,000 living, compared with a mean rate of 1·49 for the previous five years. The prevalence of plague, which began in August, was due to infection brought by refugees from Bhopal (*see* Report on Plague in the Central India Agency), where the disease at the time was seriously epidemic, to the town of Hoshangabad, which lies about 40 miles by rail from Bhopal. The measures chiefly relied upon were evacuation of invaded houses; inoculation, which is increasing in popularity, nearly 8,000 persons submitting to the operation during the year; and rat destruction. Major Stokes, in his Annual Report, observes that the only hope of controlling the spread of plague seems to lie in (1) its early detection in the rat; (2) its immediate notification when detected; (3) the control of fugitives in organised camps on selected sites outside their own towns and villages, and (4) the "quarantine" of fugitives outside the other towns for 10 days.

During 1915 plague was epidemic in the Central Provinces, 24,709 cases and 20,264 deaths being reported, giving a fatality rate of 82·0 per cent. There appear to have been two separate epidemics, the first extending from January to May and the second from August to December. The number of deaths reported, month by month, in the Central Provinces is shown in the subjoined table :—

Deaths from Plague in the Central Provinces and Berar in 1915.

1915.	Plague Deaths.
January	1,951
February	4,538
March	3,808
April	1,079
May	166
June	7
July	10
August	129
September	1,326
October	2,563
November	2,332
December	2,355
Total	20,264

Of the 20,264 fatal cases, 10,257 were males and 10,007 females. The plague death-rate was 1·46, the mean of the previous five years being 1·18. The districts in which the greatest mortality occurred were Nagpur with 8,650 (equal to a death-rate of 10·68 per 1,000), Akola with 2,857 (3·62), and Amraoti with 2,685 (3·06).

The recrudescence of plague, observed in the latter part of 1915, was continued during the first four months of 1916, during which period 10,645 more deaths from plague were recorded.

Rat destruction operations were carried on in many places, but apparently not systematically, except in Buldana, Khamgaon, and Amraoti Camp towns, in which the mortality was low as compared with neighbouring urban areas. Inoculation, as has been said, is increasing in popularity in the Central Provinces, and during 1915 no fewer than 71,421 persons were inoculated, of which 24,769 were in the Nagpur district and 11,716 in Amraoti.

During 1916 the number of plague deaths in the Central Provinces rose to 28,629, giving a death-rate of 2·06 per 1,000 living, as compared with a mean rate of 0·99 for the last five years. There were 14,939 deaths in males and 13,690 in females. The course of the 1916 prevalence of plague is shown in the following table :—

Deaths from Plague in the Central Provinces and Berar in 1916.

1916.	Plague Deaths.
January	3,762
February	3,633
March	2,777
April	473
May	27
June	7
July	101
August	822
September	2,256
October	3,907
November	4,620
December	6,244
Total	28,629

The Annual Report, for 1916, of Colonel W. H. B. Robinson, C.B., I.M.S., Sanitary Commissioner for the Central Provinces, states that 100,099 anti-plague inoculations were performed during 1916, compared with 71,421 in the previous year. Early evacuation of their houses by natives was effected satisfactorily as soon as it was recognised that rats were sick and dying in the vicinity. Camps were established round some of the towns invaded by plague, and hutting was provided by the officials.

The district which experienced the greatest ravages of plague in 1916 was Nagpur, in which 9,334 fatal cases were reported, and of these, 5,018 occurred in the city of Nagpur, the population of which is 134,008. The districts of Akola and Amraoti also suffered a good deal, the former having 4,481 deaths from plague, and the latter 4,477.

The plague prevalence which began in the latter part of 1916 was continued during 1917, and the returns for the year give the total deaths attributed to the disease in 1917 as 48,036, compared with 28,629 in 1916 and 20,264 in 1915. The progress of the 1917 prevalence is shown, month by month, in the subjoined tabular statement :—

Deaths from Plague in the Central Provinces and Berar in 1917

1917.	Plague Deaths.
January	7,149
February	9,765
March	7,030
April	3,144
May	850
June	307
July	769
August	2,435
September	3,179
October	4,336
November	4,533
December	4,539
Total	48,036

The Berar Division suffered most, having a total of 21,600 deaths, of which 7,461 occurred in the Akola district, 6,593 in Amraoti, and 5,791 in Buldana. As regards inoculation in the province, 119,098 persons submitted to it, as compared with 100,099 in the previous year.

Treatment of plague by tincture of iodine was tried in some of the districts, but the results were not encouraging.

Lieut.-Colonel Kendrick, of Jubbulpore, writes that the complete removal of the enlarged glands at the earliest stages gives the best results.*

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* Annual Sanitary Report, 1917, for the Central Provinces and Berar, by Colonel C. R. M. Green, I.M.S.

The incidence of plague in the Central Provinces and Berar from 1903 to 1917 is shown in the appended table :—

Year.	Plague.		Case Mortality per cent.	Plague Death-rate per 1,000 of the Population.
	Cases.	Deaths.		
1903 - - -	47,526	44,616	93·9	4·13
1904 - - -	49,001	42.866	87·5	3·43
1905 - - -	15,584	12,706	81·5	1·07
1906 - - -	21,167	18,121	85·6	1·53
1907 - - -	46,149	37,774	81·8	3·18
1908 - - -	7,758	6.236	80·4	0·52
1909 - - -	21,597	19,216	88·9	1·61
1910 - - -	36,708	28,961	78·9	2·42
1911 - - -	34,606	27,938	80·7	2·01
1912 - - -	23,538	19,199	81·5	1·38
1913 - - -	754	512	67·9	0·04
1914 - - -	1,068	896	83·9	0·06
1915 - - -	24,709	20,264	82·0	1·46
1916 - - -	34,793	28,629	82·3	2·06
1917 - - -	60,871	48,036	78·9	3·45
Total in 15 years -	425,829	355,970	83·6	—

The population of the Central Provinces and Berar at the 1911 Census was 16,033,310, of which 2,117,002 were comprised in Native States.

From January to June 1918 the deaths recorded from plague in the Central Provinces and Berar amounted to 9,830.

North-West Frontier Province.

Deaths from plague in the North-West Frontier Province during 1914 numbered 166, against 82 in 1913 and only 1 in 1912. With one exception, all the deaths in 1914 occurred in the Charsada subdivision of the Peshawar District. There seems little doubt that the prevalence of the disease began in that locality in the late autumn of 1913, and that cases had either not been correctly reported, or had been intentionally concealed. The presence of plague was definitely recognised in January 1914, and after that cases continued to be recorded up to October; but the number of reported deaths in this outbreak was never large in any month, the greatest number being 32, certified in March. The people generally displayed great apathy, and were inclined to resent any interference by officials. Lieut.-Colonel T. W. Irvine, I.M.S., the Chief Medical Officer of the province, states* that this is the usual frame of mind of these people, and that, unless an epidemic causes an altogether alarming mortality, the general wish is to be left alone to die as Providence may be pleased to direct. It is believed that the result of this attitude is the concealment of plague cases and deaths.

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* Report on the Sanitary Administration of the North-West Frontier Province for the year 1914, by Lieut.-Colonel T. W. Irvine, I.M.S., Chief Medical Officer.

In the Malakand Agency six deaths from plague were reported during October in the villages among the hills near Dargai; but here again, although a medical officer was specially sent to advise the natives, he was coldly received, and little use was made of his advice.

During 1915 there was an increase in the number of plague cases and deaths in this province, the totals being 569 attacks and 340 deaths. The disease broke out in March and disappeared again in June, the height of the 1915 prevalence being reached in April and May. The districts which suffered from plague in 1915 were Peshawar and Hazara, into which the infection was introduced from the Punjab. Peshawar had 147 deaths and Hazara 189; 3 deaths occurred in Kohat and 1 in Bannu. The plague death-rate for the province in 1915 was 0·17 per 1,000 of the population, the mean rate for the last five years being 0·05.

During 1916 there were only 10 plague deaths in this province, all of them in the Hazara District, namely, 2 in October and 8 in December. During 1917, 23 cases were reported, with 8 deaths. In January, 5 plague deaths were recorded and in October, 8, making 13 fatal cases for the year in the registration districts of the province; but in addition there were 7 deaths in the Sherani country, where no registration exists, making a total of 15 fatal cases during the year.*

The incidence of fatal plague in the North-West Frontier Province since 1903 is shown in the following table:—

Deaths from Plague in the North-West Frontier Province.

Year.	Plague Deaths.	Death-rate per 1,000 living.
1903 - - - -	49	0·03
1904 - - - -	1	—
1905 - - - -	3	—
1906 - - - -	41	0·02
1907 - - - -	1,547	0·81
1908 - - - -	563	0·30
1909 - - - -	1	—
1910 - - - -	30	0·02
1911 - - - -	243	0·12
1912 - - - -	1	—

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* Annual Report on the Sanitary Administration of the North-West Frontier Province for 1917, by Lieut.-Colonel T. W. Irvine, I.M.S., Chief Medical Officer.

Year.	Plague Deaths.	Death-rate per 1,000 living.
1913	82	0·04
1914	166	0·08
1915	340	0·17
1916	10	0·004
1917	8	0·004
Total in 15 years	3,085	—

The population of the North-West Frontier Province at the 1911 Census was 2,196,933.

During the first half of 1918 the deaths from plague in this province numbered 334.

The State of Mysore.

Plague has been continuously present in the State of Mysore since 1898. During 1914, 7,007 cases and 5,348 deaths were reported and, in 1915, 5,877 cases and 4,245 deaths. In 1916 there was a considerable increase in the manifestations of plague in this State, for 14,545 cases and 10,976 deaths were recorded. This increased incidence was maintained during 1917, when 10,410 deaths were officially reported. The distribution of the plague deaths, month by month, during these four years is shown in the following table :—

The Seasonal Incidence of Fatal Plague in the State of Mysore,
1914 *to* 1917.

	1914.	1915.	1916.	1917.
January	472	539	701	1,317
February	333	623	548	1,069
March	265	409	282	619
April	143	177	130	252
May	57	56	137	191
June	70	100	227	212
July	165	110	687	552
August	430	263	1,266	1,038
September	964	342	1,782	1,212
October	834	462	1,850	1,407
November	778	524	1,758	1,452
December	837	640	1,608	1,089
Total	5,348	4,245	10,976	10,410

The figures are taken from the Annual Reports of the Sanitary Commissioner with Government of India, and include the Bangalore Civil and Military Stations.

During the first six months of 1918 the deaths recorded from plague in Mysore amounted to 3,288.

The progress of plague in Mysore from 1898 to 1917 is shown in the subjoined table :—

Plague in the State of Mysore, 1898 *to* 1917.

Year.	Cases.	Deaths.	Case-mortality per cent.
1898 - - - - - -	6,569	5,335	81·2
1899 - - - - - -	8,836	6,742	76·3
1900 - - - - - -	17,006	12,987	76·4
1901 - - - - - -	17,121	12,602	73·6
1902 - - - - - -	38,811	28,278	72·9
1903 - - - - - -	29,405	22,291	75·8
1904 - - - - - -	32,949	24,196	73·4
1905 - - - - - -	7,827	3,959	50·6
1906 - - - - - -	5,440	4,010	73·7
1907 - - - - - -	17,911	13,107	73·2
1908 - - - - - -	10,791	7,883	73·1
1909 - - - - - -	6,220	4,508	72·5
1910 - - - - - -	10,385	7,142	68·8
1911 - - - - - -	20,931	15,465	73·9
1912 - - - - - -	8,012	5,967	74·5
1913 - - - - - -	5,936	4,261	71·8
1914 - - - - - -	7,007	5,348	76·3
1915 - - - - - -	5,877	4,245	72·2
1916 - - - - - -	14,545	10,976	75·4
1917 - - - - - -	15,084	10,410	69·0
Total - - -	286,663	209,712	73·1

The number of plague attacks for each year has been obtained from the weekly Preliminary Statements of Plague Seizures in India.

The population of the Mysore State at the Census of 1911 was 5,806,193.

The Hyderabad State.

The Native State of Hyderabad, like Mysore, has suffered from a prevalence of plague year by year since 1898, and the prospects of any cessation of the ravages of the disease in this State are not encouraging at the present time. During 1914 the number of reported cases was 3,446 and the deaths 2,771, as compared with 4,112 attacks and 3,370 deaths in the previous year. In 1915 there was a marked increase in the amount of plague reported in Hyderabad, for 92,213 fatal cases were recorded. This increase was continued during 1916 and 1917, for in the former year 44,548 deaths came under observation, and in the latter year 54,674, of which latter number 14,053 occurred in Hyderabad city (population, 500,000). The incidence of fatal plague in the State of Hyderabad during these four years is shown, month by month, in the subjoined table :—

The Seasonal Incidence of fatal Plague in the Hyderabad State, 1914 *to* 1917.

——	1914.	1915.	1916.	1917.
January	362	134	3,955	12,960
February	243	327	6,619	4,766
March	129	259	5,710	5,881
April	54	313	2,420	2,840
May	4	56	571	1,699
June	—	8	74	489
July	—	—	1,429	1,901
August	305	471	3,500	3,337
September	569	679	3,347	3,320
October	572	1,137	3,913	4,519
November	294	1,753	5,045	5,035
December	239	4,076	7,965	7,927
Totals	2,771	9,213	44,548	54,674

The population of this State at the 1911 Census was 13,374,676. The amount of plague that has occurred in the Native State of Hyderabad since 1897 is shown in the next table. The two last years, 1916 and 1917, give the highest number of deaths from the disease in any year since 1897, when plague invaded the State.

The Incidence of Fatal Plague in the State of Hyderabad, 1897 *to* 1917.

Year.	Plague Deaths.
1897	8
1898	3,868
1899	6,378
1900	928
1901	95
1902	2,689
1903	27,697
1904	25,596
1905	10,862
1906	1,250
1907	3,038
1908	1,625
1909	493
1910	5,366
1911	17,579
1912	15,943
1913	3,370

Year.	Plague Deaths.
1914	2,771
1915	9,213
1916	44,548
1917	54,674
Total in 21 years	237,991

During the first half of 1918 the deaths reported from plague in the State of Hyderabad numbered 11,206.

Rajputana and Ajmer-Merwara.

According to a report by Lieut.-Colonel W. H. B. Robinson, I.M.S., Chief Medical Officer in Rajputana, for the fiscal year ended 31st March 1914, there were, during that period, 2,286 cases of plague, with 1,885 deaths, in 103 towns and villages distributed over seven Native States. In the previous 12 months there had been 6,037 attacks, 5,672 fatal, in 83 towns and villages included in nine Native States. A still more recent report dealing with the fiscal year ended 31st March 1915, by Lieut.-Colonel R. Charles Macwatt, I.M.S., now Chief Medical Officer in Rajputana, gives the plague attacks in that period as 570 and the deaths as 458, reported in 44 towns and villages. The following table shows the incidence of plague during the two fiscal years ended 31st March 1915, in the various Native States of Rajputana :—

Native States.	Population, 1911.	Year ended March 31, 1914.		Year ended March 31, 1915.		Remarks.
		Plague		Plague		
		Cases.	Deaths.	Cases.	Deaths.	
Bharatpur	558,785	965	753	198	122	
Karauli	146,587	1*	1	—	—	* Imported case.
Jaipur	2,636,647	674	619	227	222	
Alwar	791,688	603	475	133	109	
Kotah	639,089	25	24	—	—	
Marwar	2,057,553	14†	13	6†	4	† All imported cases.
Sirohi	189,127	4	—	6‡	1	‡ Imported cases.
	—	2,286	1,885	570	458	

Reckoned on these figures, the case mortality-rate from plague in Rajputana was 82.4 per cent. in the first of these 12 months, and 80.3 in the second.

According to the weekly preliminary statements as to plague seizures and deaths in India during the calendar year 1914, there were altogether 1,434 attacks and 1,165 deaths in the Province of Rajputana and Ajmer-Merwara, the most of the cases occurring during the first half of the year.

Evacuation is the measure which is most readily carried out in the invaded towns and villages, the people themselves now recognising, as a result of previous experience, the value of this preventive procedure.

In the 12 months from 1st April 1915 to 31st March 1916, 135 persons were attacked by plague in Ajmer-Merwara and Rajputana, and 109 of them died. These cases were distributed over 17 towns and villages.

During the fiscal year from 1st April 1916 to 31st March 1917 there occurred 1,633 plague cases and 1,285 deaths in the Ajmer-Merwara district and in the Native States of Rajputana. These were distributed over 59 towns and villages; 856 attacks and 643 deaths were referred to Ajmer-Merwara, 396 cases and 296 deaths occurring in Ajmer city. During the fiscal year the infection was imported on several occasions from outside places, including Karachi.

The distribution of the cases and deaths during the two years 1915–16 and 1916–17 among the districts and States is shown in the subjoined table:—

—	1915–16.		1916–17.	
	Cases.	Deaths.	Cases.	Deaths.
Mewar	1	1	63	35
Sirohi	5	1	3	2
Marwar	57	50	371	334
Ajmer Merwara	—	—	856	643
Tonk	—	—	13	8
Kishangarh	—	—	92	69
Jaipur	2	1	159	146
Alwar	1	1	19	13
Bharatpur	69	55	57	35
	135	109	1,633	1,285

Evacuation was readily adopted by the inhabitants of the invaded towns and villages, as they recognised the utility of the measure; 9,316 persons accepted prophylactic inoculation, of whom 6,654 were in the Nasirabad Cantonment, 2,621 in Ajmer City, and 41 at Ramsar.*

During the 12 months period ended 31st March 1918 there was a great increase in the amount of reported plague throughout the province, no fewer than 116,168 persons being attacked, of whom 98,192, or 84·5 per cent., died. The number of towns and villages invaded rose to 2,101. Of the total attacks and deaths, 102,955 of the former and 88,522 of the latter occurred in the Native States, and 13,213 cases with 9,670 deaths in the Ajmer-Merwara District.

The chief Native States that suffered from plague in 1917–18 were Jaipur, with 25,147 cases and 23,994 deaths; Marwar, 25,440 attacks, 22,937 of which were fatal, and Mewar, 14,452 cases, 11,938 of which died. Alwar had 9,565 attacks and 7,723 deaths; Bharatpur, 8,256, of which 6,495 proved fatal, and Kotah, 6,456 attacks and 4,856 deaths.

With a view to meet this excessive incidence of plague during 1917–18, pamphlets in English, Urdu and Hindi were distributed, giving information as to the prevention of the disease; rat traps were issued to all householders who asked for them, but most of the people of the Native States are opposed to rat destruction; all compounds and houses in the Ajmer Civil Lines were inspected daily; disinfection was carried out when necessary. Evacuation, as in previous years, was readily accepted by the villagers. Inoculation by Haffkine's method was performed on 90,948 persons; of these, 16,790 were done in Marwar State, 14,028 in Jaipur city, 10,579 in Bundi State, 10,508 in Mewar State, and 8,000 in Jhalawar State.

The following table gives the number of deaths from plague in each of the 22 calendar years, 1897 to 1918, in Rajputana and Ajmer-Merwara :—

Year.	Plague Deaths.
1897	40
1898	136
1899	24
1900	14
1901	185
1902	139
1903	2,450
1904	19,426
1905	32,563
1906	12,000
1907	5,839
1908	7,936
1909	12,160

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* Report on Sanitation, Dispensaries and Jails in Rajputana for 1916, by Lieut.-Colonel R. Charles Macwatt, I.M.S., Chief Medical Officer Rajputana.

Year.	Plague Deaths.
1910	41,095
1911	18,782
1912	5,786
1913	2,487
1914	1,165
1915	134
1916	119
1917	46,944
1918	78,938*
Total in 22 years	288,362

From the above it would appear that 1918 was the worst year for plague in Rajputana and Ajmer-Merwara since the disease first appeared in the province in 1897. The population of Rajputana and Ajmer-Merwara in 1911 was 11,031,827, of which 10,530,432 were in Rajputana and 501,395 in Ajmer-Merwara.

Baluchistan.

No cases or deaths from plague were reported in Baluchistan during 1914, and only one imported non-fatal case in 1915. Nor in 1916 and 1917 was any plague reported in this province.

From 1896 to 1901, 21 fatal cases of plague occurred in Baluchistan. From 1902 up to 1911 deaths were recorded from the disease, though not in any large numbers. From 1912 to 1917 there were only three fatal cases, all in 1917.

The following table shows, year by year, the fatal incidence of plague in Baluchistan :—

Year.	Plague Deaths.
1896 to 1901	21
1902	30
1903	3
1904	25
1905	—
1906	7
1907	5
1908	1
1909	1
1910	21
1911	3
1912 to 1917	3
Total in 22 years	120

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* Provisional figures for 1918.

The population of Baluchistan at the Census of 1911 was 834,703, of which 420,291 belonged to Native States.

The Kashmir State.

In the Native State of Kashmir and Jammu, which is situated in the extreme North of India, in a mountainous region forming part of the Himalayas, 489 cases of plague with 278 deaths were reported during 1914, as compared with 272 attacks, 138 of which proved fatal, in the previous year. The greatest incidence of the disease was observed in April and May, in which 137 deaths occurred and, again, in November and December, when 91 fatal cases were recorded. The end of the year showed signs of a recrudescence of plague in the State, and this developed into an epidemic in the first half of 1915, as will be seen in the following table giving the cases and deaths recorded, month by month, during the year :—

Deaths from Plague in Kashmir and Jammu in 1915.

	Deaths.
January	73
February	183
March	383
April	525
May	1,016
June	269
July	—
August	—
September	—
October	—
November	42
December	68
	2,559*

In 1916 the number of plague deaths fell to 118 and, in 1917, 479 fatal cases were reported. The distribution of these deaths throughout the months of 1916 and 1917 is given in the subjoined table :—

Deaths from Plague in Kashmir and Jammu in 1916 *and* 1917.

	1916.	1917.
January	61	5
February	18	27

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* All of these deaths occurred in Jammu.

	1916.	1917.
March	11	28
April	4	47
May	18	64
June	6	75
July	—	5
August	—	3
September	—	9
October	—	62
November	—	64
December	—	90
	118*	479*

The population of Kashmir at the 1911 Census was 3,158,126. The incidence of plague in this Native State has been as follows :—

Deaths from Plague in Kashmir and Jammu, 1896 *to* 1917.

Year.	Deaths.
From 1896 to 1901	1,852
1902	5,690
1903	1,103
1904	8,691
1905	2,669
1906	2,736
1907	3,017
1908	61
1909	156
1910	339
1911	1,096
1912	365
1913	138
1914	278
1915	2,559
1916	118
1917	479
Total in 22 years	31,347

During the first half of 1918 the prevalence of plague continued in Kashmir and Jammu, the fatal cases numbering 3,079.

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† All of these occurred in Jammu.

The Central India Agency.

During 1914, 3,472 cases and 2,285 deaths from plague were recorded in the Central India Agency, the great majority of the fatal cases, namely, 2,236, occurring in the State of Bhopal. Of the remainder, 47 deaths were referred to the Gwalior State and two to Indore; in both the latter instances the infection was derived from Bhopal. The case mortality-rate reckoned on the above figures was 65·8 per cent.

During 1915 the reported plague attacks amounted to 3,543 and the deaths to 2,651, giving a fatality-rate of 74·8 per cent. The greatest incidence was in the Indore State, in which 1,726 of the total plague deaths were recorded. In Bhopal State there were 819 deaths from plague and 99 in Gwalior. There was a considerable outbreak of the disease in Indore city, where, in the month of November alone, 509 persons died of plague.*

The distribution of the plague cases and deaths in the Central India Agency is shown, month by month, in the following table :—

Plague in the Central India Agency in 1914 *and* 1915.†

—	1914.		1915.	
	Cases.	Deaths.	Cases.	Deaths.
January - - - -	71	54	170	135
February - - -	84	54	294	256
March - - - -	65	44	340	317
April - - - -	81	52	213	144
May - - - -	7	5	36	12
June - - - -	—	—	—	—
July - - - -	1	—	—	—
August - - - -	30	26	79	52
September - - -	1,325	572	261	121
October - - - -	863	857	764	498
November - - -	534	265	723	575
December - - -	411	356	663	541
Totals -	3,472	2,285	3,543	2,651

The population of the Central India Agency at the census of 1911 was 9,356,980, and in this administrative area are included Indore, Gwalior, Bhopal, Bundelkhand, Baghelkhand, Malwa, and the southern Native States of Central India.

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* Annual Reports of Lieut.-Colonel F. A. Smith, I.M.S., Administrative Medical Officer in Central India, for the years 1914–1915.

† The number of attacks is the aggregate of the weekly returns of plague seizures sent to the India Office; and the deaths are taken from Lieut.-Colonel Smith's annual reports for 1914 and 1915.

During 1916 plague caused 2,349 deaths in the Central India Agency. The disease was present at the beginning of the year in Gwalior, Bhopal, Indore, and Malwa, but disappeared during the hot season, which, in this year, was hotter than usual; but at the end of the rainy season plague reappeared, the largest number of deaths being recorded in December. Indore had the highest mortality, 1,777 deaths being referred to it; of these, 1,428 occurred in Indore City. Lieut.-Colonel F. A. Smith, I.M.S., Administrative Medical Officer for the Agency, states that the protection afforded by inoculation in Indore was very apparent and was fully appreciated by the inhabitants. The following table gives the seasonal incidence of fatal plague in the various parts of the Central India Agency during 1916 :—

1916.	Gwalior.	Bhopal.	Malwa.	Southern States.	Indore.	Total.
January	8	39	26	—	283	356
February	24	27	31	2	80	164
March	30	1	22	7	48	108
April	11	—	—	—	11	22
May	—	—	—	—	—	—
June	—	—	—	—	—	—
July	—	—	—	—	2	2
August	—	—	—	6	30	36
September	—	—	—	10	144	154
October	14	—	1	16	356	387
November	79	—	6	13	344	442
December	164	—	14	21	479	678
	330	67	100	75	1,777	2,349

During 1917 the incidence of plague in the Central India Agency greatly increased, the deaths amounting to 15,086. The increased incidence of plague seemed to be associated with humidity of atmosphere, a condition in which rats are more infested by fleas than at other times; rats also during the annual rains seek shelter inside houses more than in dry weather. The shortness and the mildness of the hot season of 1917, with the early onset of the rainy season, greatly contributed to the severity of the epidemic of the year. In more normal years the hot and dry weather kills the epidemic and practically removes all foci of infection.* But in 1917 the infection remained during the summer season in all affected districts. The worst month was October, during which 3,027 plague deaths occurred. The appended table gives the number of deaths in each of the Native States of the Agency, month by month, for 1917 :—

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* Annual Report on the Central India Agency for 1917–18 b Lieut.-Colonel F. A. Smith, I.M.S., Administrative Medical Officer i Central India.

Deaths from Plague in the Central India Agency in 1917.

1917.	Gwalior.	Baghel-khand.	Bundel-khand.	Bhopal.	Malwa.	Southern States of Central India.	Indore.	Total.
January -	305	—	—	—	81	34	458	878
February -	555	—	1	—	89	104	429	1,178
March - -	386	13	1	1	107	21	284	813
April - -	267	37	—	4	10	6	142	466
May - -	147	11	—	16	—	—	21	195
June - -	69	1	—	—	—	—	—	70
July - -	397	—	—	18	8	3	63	489
August -	841	—	—	234	198	6	253	1,532
September -	930	—	—	825	351	49	352	2,507
October -	786	—	—	1,342	175	11	713	3,027
November -	602	44	3	421	177	82	832	2,161
December -	550	17	34	426	553	175	15	1,770
Totals -	5,835	123	39	3,287	1,749	491	3,562	15,086

Inoculation, evacuation, and rat destruction were the chief measures adopted for controlling the epidemic.

The course followed by fatal plague in the Central India Agency from 1897 to 1917 is shown in the subjoined table :—

Deaths from Plague in the Central India Agency from 1897 *to* 1917.

Year.	Plague Deaths.
1897 to 1902 - - - - -	476
1903 - - - - - - -	26,169
1904 - - - - - - -	26,545
1905 - - - - - - -	2,836
1906 - - - - - - -	12,055
1907 - - - - - - -	8,809
1908 - - - - - - -	1,404
1909 - - - - - - -	3,533
1910 - - - - - - -	6,083
1911 - - - - - - -	16,129
1912 - - - - - - -	5,282
1913 - - - - - - -	173
1914 - - - - - - -	2,285
1915 - - - - - - -	2,651
1916 - - - - - - -	2,349
1917 - - - - - - -	15,086
Total in 21 years - - -	131,865

During the first six months of 1918 plague continued to be epidemic in the Central India Agency and caused 9,996 deaths.

Coorg.

Coorg is one of the smallest administrative areas in India; its population at the 1911 Census was 174,976. In it during 1914, 18 cases of plague were reported, with 10 deaths. In 1915 only three cases, two fatal, were recorded, and during 1916 the cases were three, all terminating fatally; while, in 1917, there were 14 cases with 9 deaths. It will be seen from the above that Coorg has not experienced any severe prevalence of the disease in recent years. The fatal incidence of plague in Coorg since 1901 up to 1917 is shown in the next table:—

Year.	Plague Deaths.
1901	—
1902	—
1903	44
1904	25
1905	—
1906	—
1907	2
1908	26
1909	2
1910	9
1911	57
1912	9
1913	162
1914	10
1915	2
1916	3
1917	9
Total in 17 years	360

Assam.

During 1914 only a single case of plague was reported in Assam, and it was an imported instance which had been brought into the Goalpara district from Ballia in the United Provinces. There had been no recorded cases in the previous year, and none was heard of in 1915, 1916, or 1917. Assam had at the 1911 Census a population of more than six millions. For administrative purposes it was formerly joined to Eastern Bengal, but was reconstituted a separate province in April 1912. Since that date there has only been a single plague case (the one in 1914 mentioned above); so that for six years it has been practically free from plague, although most of the other provinces of India have been, during that period, suffering from the ravages of the disease. The reasons for this immunity are, it is said, connected with the habits and customs of the people and the construction of their dwellings, which do not favour infestation by rats.

Portuguese India.

During May 1915 plague was reported to be present at Vasco di Gama, in Goa, a Portuguese possession situated on the West coast of India, about 250 miles south of Bombay. But no details of the outbreak have as yet come to hand. Usually there is difficulty in obtaining information from Portuguese officials as to the incidence of infectious diseases in their territory. There is no information that any plague occurred in Coorg during 1916 or 1917. Though Goanese stewards on board Indian steamers seem to be susceptible to the plague infection when exposed to it, there have been no epidemics, apparently, in Goa itself. A few cases occurred there as far back as 1899. In Damann (or Daman), a Portuguese settlement and port in Gujerat on the Gulf of Cambay, 100 miles north of Bombay, with a population of 56,000, plague was epidemic in 1897, when 2,352 persons died of the disease and the epidemic continued during 1898 and 1899, when 504 persons were attacked, of whom 303, or 60·1 per cent., died. Since then no report of plague in Damann has been received.

Ceylon.

(Population, 1911, 442,300.)

For some years surprise had been expressed that, notwithstanding the long-continued prevalence of plague in India, there had not been, beyond a few imported cases, any outbreak of the disease in Ceylon. But at the beginning of 1914 the malady at last found a footing in Colombo, the capital and chief port of the island, with a population of 185,704. The first intimation was in the form of an anonymous communication to the Health Department of that city to the effect that a rapidly fatal disease was then appearing in certain native insanitary quarters, particularly along the water-front. Investigation, at once instituted by Dr. Aldo Castellani and Dr. Marshall Philip, revealed the fact that the current malady was plague of the septicæmic type. So far as could be traced at the time, this outbreak had not been preceded by any epizootic among the local rats; but, later, some infected rodents were found, the suggestion being that the rat-infection had been acquired from man and not *vice versâ*. It was surmised that plague had been introduced into Colombo by persons from Southern India; another suggestion was that plague might have been occurring in Colombo or elsewhere in Ceylon in a mild or unrecognised form for some time, and that its presence was only discovered after the infection, through local circumstances, had acquired fresh virulence, and after developing into a rapidly fatal septicæmic form. Discovered in January 1914, plague continued to occur in Colombo throughout the year and continuing during 1915. In both years the chief focus of the disease was in the Sea Street area. The comparative absence of the usual signs of an epizootic of plague in rats, so conspicuous in 1914, was repeated in 1915. The total number of rats destroyed was 142,015 in 1914, and 147,198 in 1915; of these, the numbers sent for examination at the Municipal Laboratory were, respectively, 17,579 and 23,354. In 1914 250 were found infected by plague and 57 in 1915, that is, 1·4 per cent. of those examined in the former year, and ·2 per cent. in the latter. During December 1914 a mummified cat, which had probably died of plague, was discovered when a rat-run under a floor was opened up in a house where three human cases had been reported. The total human cases and deaths reported in 1914 were, respectively, 413 and 381, giving a case mortality-rate of 92·2 per cent., the corresponding figures for 1915 being 139 cases, 128 deaths, and a fatality-rate of 92·1 per cent.; 247 septicæmic cases were observed in 1914 and 81 in 1915.

The largest proportion of those attacked were young adults, and male cases were more numerous than female. From Colombo the infection in 1914 was carried to various other places in Ceylon, including Jaffna, Kurungela, Kandy, and Kalutaru, but the cases at these places were only sporadic. In a report by Dr. Philip in December 1914 it is stated that he had suspicions that there were more deaths caused by plague in Colombo than those reported to the authorities, and he had consequently insisted upon having post-mortem examinations made in all instances where the cause of death was in any doubt.

The Government, in order to reduce the danger arising from rat-infestation of wholesale grain warehouses in the town close to crowded dwellings, erected a series of rat-proof rice stores, which were kept under official control and supervision. The other measures chiefly relied upon to check the human outbreak were isolation of the sick, segregation of contacts, evacuation of insanitary tenements pending the carrying out of structural improvements, "pesterining" of infected houses, and the fumigation of rat-runs by means of a Clayton machine. Inoculation by Haffkine's fluid was offered to the public, but very few accepted this protection.*

During 1916 291 cases and 273 deaths from plague were reported in Colombo, giving a case mortality rate of 93·8 per cent. As in the two previous years the chief focus of both human and rat plague in Colombo was in the Sea Street area, in which there is an old system of underground insanitary drains much infested by rats; the bulk of the wholesale grain stores are in this area, where little had been done to render them rat-proof. In other parts of the town the occurrence of the disease was associated with crowded, insanitary tenements, invariably found to be infested by rats. During 1916 the rats found dead or destroyed amounted to 146,751, of which 22,476 were submitted to bacteriological examination, 62 being found infected by plague. A Clayton apparatus was used to fumigate rat-runs. Inoculation with Haffkine's prophylactic was tried, but had to be abandoned on account of its unpopularity with the natives. The comparative absence of an extensive plague epizootic among the rats of Colombo was again a striking feature in the human prevalence during 1916; in this connection it is suggested that many rats may have died in their underground runs and were, therefore, never discovered. Thirteen deaths from plague occurred outside Colombo in other parts of Ceylon, including two persons who died in the train on their way to India.

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* Report on Ceylon for 1915, Colonial Annual Reports No. 904.

From the returns that have been received for 1917, it appears that 227 cases and 196 deaths from plague occurred in Colombo during the year, giving a case mortality-rate of 86·3. The largest number of those infected in 1917 were, as in former years, young adults, males being attacked much more frequently than females. The disease was largely limited to occupants of insanitary tenements. The better class members of the community living in the more sanitary parts of the town entirely escaped the infection.

Of a total of 23,382 rats examined bacteriologically during 1917 only 73, or 0·3 per cent., were found infected by plague. The highest rat mortality was observed during February, March, and April, coinciding with the human incidence of the disease.

Three out of six cats examined were found infected.*

The seasonal distribution of plague during the four years 1914, 1915, 1916, and 1917 is shown in the following table :—

Reported Plague Cases in Colombo during 1914, 1915, 1916, *and* 1917.

——	1914.	1915.	1916.	1917.
January - - -	4	19	17	25
February - -	67	6	18	40
March - - -	58	3	18	61
April - - - -	28	3	14	54
May - - - -	29	3	11	11
June - - - -	49	1	36	3
July - - - -	47	5	43	6
August - - - -	40	20	35	1
September - - -	18	21	25	3
October - - - -	23	24	24	7
November - - -	24	10	25	10
December - - -	26	24	25	6
	413	139	291	227†
Deaths - - -	381	128	273	196
Case mortality rate -	92·2	92·1	93·8	86·3

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* Annual Report to the Colonial Office on Ceylon for 1917.

† Including 10 cases infected in Colombo, but which escaped from the town and were detected elsewhere.

Plague continued to appear in Colombo during the first half of 1918, about 62 deaths from the disease being recorded; and out of upwards of 9,000 rats examined, 45 were found infected during the same period.

The Straits Settlements.

Fourteen fatal cases of plague were recorded during 1914 in the Straits Settlements, at Singapore, as compared with only one case during the previous year. The first cases were observed in the month of May, and during an interval, lasting from June to September, the colony was free from the disease, which, however, reappeared in the latter month, cases being reported up to the end of December. Plague continued to appear at Singapore during 1915, and during the year 33 fatal cases came under observation. During 1916 there were 23 deaths recorded from plague in the Straits Settlements; of these deaths, 15 occurred at Singapore, where 21 cases were notified. Plague continued to appear in the colony during 1917, and up to the end of December 50 cases and 39 deaths had come under observation at Singapore. A few cases, two of them fatal, were also reported at Penang.

So far as can be ascertained the deaths from plague in the Straits Settlements during the past eight years were as follows:—

Year.	Plague Deaths.
1910	5
1911	32
1912	33
1913	1
1914	14
1915	33
1916	23
1917	39

From its position as regards other infected countries, Singapore is much exposed to the risks of imported infection by shipping. It is creditable to its sanitary administration that no outbreaks of a very serious nature have so far resulted at this port. The population of the Straits Settlements in 1911 was a little over one million, and of Singapore about 230,000.

In the earlier months of 1918 plague became more prevalent in Singapore. Up to the middle of May 118 persons had been attacked and 98 died, giving a case mortality rate of 83 per cent.

The Dutch East Indies.

Plague was epidemic in the Dutch East Indies during 1913, and its ravages were continued in 1914, especially in the island of

Java, where 15,756 cases and 13,956 deaths were officially reported as compared wlth 11,218 attacks, 10,566 fatal, in 1913. The recorded cases and deaths in 1914 were distributed over six Javanese provinces as follows :—

Province.	Plague Cases.	Plague Deaths.
Passeroean - - - -	9,236	8,059
Kediri - - - - -	4,098	3,748
Madioen - - - -	1,316	1,154
Soerabaya - - - -	1,010	995
Soerakarta - - - -	5	—
Madoera - - - -	91	—
Total - - -	15,756	13,956

Reckoned upon the above figures the case mortality rate was 88·5 per cent., as against 92·4 in the previous year. The first four of the provinces just mentioned are in the Eastern portion of Java, to which the epidemic of plague in 1913 and 1914 was mostly confined. In the province of Passeroean, the Malang district was the chief sufferer, and in it 9,048, out of the total 9,236 cases reported in the province, were referred to it; this district, it may be mentioned, suffered most in the epidemic of 1913. In the province of Kediri, the district of that name and the district of Paree contributed the largest number of attacks, having, respectively, 1,558 and 1,701 referred to them. In Madioen province, the Madioen district was the chief sufferer, having 792 of the recorded cases; and in the Soerabaya province, the seaport town of that name had 950 out of the 1,010 attacks. The island of Madura or Madoera, which lies close to the north-eastern corner of Java, is generally classed along with that island for administrative purposes. Plague was present in Madura during 1914, but not in great amount, only 90 cases and 60 deaths coming under official observation.

Though no mention is made of infected rats in any of the reports received from the Dutch East Indies in 1914, it is known that during 1913 there was an epizootic of plague in Java among the local rodents.

The following table shows the seasonal distribution of the plague cases and deaths in Java during 1914 :—

1914.	Plague Cases.	Plague Deaths.
January - - - - -	1,146	1,005
February - - - - -	1,136	1,030
March - - - - -	1,147	1,050
April - - - - -	1,273	1,166
May - - - - -	1,209	1,054

1914.	Plague Cases.	Plague Deaths.
June	1,305	1,165
July	1,293	1,134
August	1,675	1,456
September	2,039	1,753
October	1,661	1,474
November	901	804
December	971	865
Total	15,756	13,956

During 1915 plague was again epidemic in Java, some 6,237 cases and 5,314 deaths being reported, giving the high case mortality-rate of 84·7 per cent. The chief prevalences were observed in the district of Malang in the province of Passeroean, where 2,552 cases and 2,404 deaths from the disease were recorded; in the province of Kediri, 1,648 attacks were reported with 1,573 deaths; in the province of Soerakarta, 920 cases with 869 deaths came under observation; and in the province of Soerabaya, 237 persons died of the disease, of whom 189 were referred to the seaport town of Soerabaya. Nearly half of the whole 6,237 cases of plague recorded in Java during 1915, namely, 2,912, occurred in the first quarter of the year. Dr. W. A. Borger, Assistant Director of the Pasteur Institute at Weltevreden (Java), contracted pneumonic plague towards the end of the year while engaged in working with broth-cultures of the bacillus pestis in the process of preparing a prophylactic vaccine against plague, a work in which he had been employed for a period of two years. His illness lasted only four days, and proved fatal. He had habitually used elaborate precautions against the disease, but did not wear a mask, and to this omission his infection is believed to have been due. Another account, published in 1916 in Batavia, states that Dr. Borger contracted plague through the accidental breaking of a glass tube containing cultures of B. pestis. His hand was cut when the tube broke and he was thus inoculated with the plague virus. He had on a previous occasion some years ago contracted plague, but had made a good recovery.

The prevalence of plague in the Dutch East Indies continued during 1916, but in considerably reduced amount, the reported cases numbering 1,188, of which 1,176 were fatal. If these figures are correct, the case mortality-rate was nearly 99 per cent., but it is very probable that all the attacks were not reported. There is evidence that some of the cases were of the pneumonic type, which has a high fatality rate. Most of the cases (917) were reported during the first quarter of the year, 98 in the second, 72 in the third, and 101 in the fourth quarter. During 1916 the Provinces of Soerakarta, Kediri and Soerabaya suffered most, the reported cases being, respectively, 575, 244, and 216.

During 1917 plague was still present in the Dutch East Indies, but there was a great reduction in its incidence, only 303 cases and 296 deaths being reported.

The recent prevalence of plague in the Dutch East Indies appears to have begun in 1910, for which year, however, the reports are incomplete. From the beginning of 1911 to the end of 1917 the number of persons reported to have been attacked by the disease was 39,301, of whom 34,732, or 88·4 per cent., died.

The following table gives the number of cases and deaths recorded in each year from 1911 to 1917 :—

Plague Incidence in the Dutch East Indies.

Year.	Plague		Case Mortality-rate per cent.
	Cases.	Deaths.	
1911 - - - - - -	2,155	1,448	67·2
1912 - - - - - -	2,276	2,022	88·8
1913 - - - - - -	11,386	10,520	92·4
1914 - - - - - -	15,756	13,956	88·5
1915 - - - - - -	6,237	5,314	84·7
1916 - - - - - -	1,188	1,176	98·9
1917 - - - - - -	303	296	97·6
Total for 7 years -	39,301	34,732	88·4

The ravages of plague during the last seven years have been chiefly experienced by the island of Java, more particularly its eastern portion. The population of Java, with Madura, is about 30,000,000.

SIAM.

During 1914 some 70 fatal cases of plague were recorded in Bangkok, the capital of Siam, which has a population of 628,675. The majority of these deaths occurred in the first quarter of the year, though sporadic fatal cases were reported up to October. The number of persons attacked by the disease in 1914 has not been ascertained.

According to a Consular Report, plague appeared in March 1914, at Den-Chai, the station connecting the Phre Railway. This station was closed for a month and the disease subsided. The number of cases and deaths has not been stated.

Plague was present in the city of Bangkok during 1915, but only 24 deaths from it were reported, most of them occurring in the first quarter of the year. At the beginning of 1916 the disease began to assume more epidemic proportions, and 251 deaths were recorded from it in the first three months of the year. The total cases reported during 1916 were 450, of which 407, or 90·4 per cent., died. There was a considerable reduction in the amount of plague observed in Bangkok during 1917, for the number of deaths fell to 91 for the year, as compared with 407 in 1916. The information regarding the incidence of plague in Siam is scanty, and little, beyond the bare figures from Bangkok as to fatal cases, is received in this country.

The progress of fatal plague in Bangkok, so far as can be ascertained, has been as shown in the subjoined table during the past seven years :—

Deaths from Plague in Bangkok, 1911 *to* 1917.

Year.	Plague Deaths.
1911	89
1912	28
1913	64
1914	70
1915	24
1916	407
1917	91

During the period January to June, 1918, plague caused 190 deaths in Bangkok.

INDO-CHINA.

Plague occurred during 1914 in each of the States comprised in French Indo-China, but in less amount than in the previous year, the total reported cases numbering 2,373 and the deaths 1,658, the case mortality rate being 69·8 per cent. The corresponding figures for 1913 were 4,699 attacks, 4,416 fatal, giving a case mortality rate of 94 per cent.

Tonkin has suffered less in late years from the ravages of plague than the other States of Indo-China, and in 1914 its position in this respect remained unaltered. Among the few places invaded during the year may be mentioned the seaport-town of Haiphong, where some 15 persons were attacked, 11 of whom died.

Annam.—Plague has been present in Annam for the last four or five years, and in 1913 attacked 1,791 persons, of whom 1,729 died. In 1914 there were 1,360 cases and 912 deaths, and of these 397 attacks and 338 deaths were referred to the district of Phantiet (sometimes called Manthiet) in the province of Binh-Thuan; and 868 cases, 500 fatal, in Phaurang (or Phanlang or Matrang) in the north of the same province.

Cochinchina.—During 1914 the reported cases of plague numbered 345 and the deaths 141; but these figures are incomplete. The largest number of cases occurred in the town of

Cholon, where 149 persons were attacked, and Saigon, the capital, where 113 cases were recorded.

Cambodia.—Plague has been prevalent in this State during the past four years. In 1914 some 350 cases and 289 deaths came under observation, and of these 327 of the attacks and 190 of the deaths occurred at Pnom-Penh, the capital and chief seaport of the State. It is of interest to mention that, in October 1914, the body of a recently dead shrew (*crocidura murina*) was found at Pnom-Penh in the house of a Chinaman who had died of plague. In its glands, liver and spleen were found the plague bacilli, and when these were injected into mice and guinea-pigs, the animals died of plague. Dr. J. Kerandel, who made the observations, suggests that the shrew in Cambodia may play a part in the spread of plague similar to that of the rat.

Quang-Tcheou-Wan, though really Chinese territory, is leased to the French and is now regarded as part of Indo-China. During 1914 there were 302 attacks of plague and 287 deaths, against 2,064 cases and 2,053 deaths during 1913. The majority of the cases and deaths were reported from Taiping.

Plague continued to be present in Indo-China during 1915, but in less amount than in the two previous years, the reported cases numbering 1,030 and the deaths 814, giving a case mortality-rate of 79 per cent.

In *Annam* 305 attacks, of which 183 were fatal, came under observation during the year, and, of these, 121 cases and 71 deaths were referred to Phaurang, and 93 (42 fatal) to Phantiet, in both of which districts plague had been epidemic during the preceding year. During 1915 there were 976 cases of plague and 767 deaths in this state.

In *Cochinchina* only 125 cases and 77 deaths were recorded in 1915, 41 of the attacks and 26 of the deaths occurring in the town of Cholon. Only two cases came under notice in Saigon, the capital.*

In *Cambodge* there were 176 cases, all reported as fatal, suggesting that only the deaths and not the attacks were recorded. Of this number, 145 deaths were referred to Pnom-Penh, the capital of the State, where in the previous year plague had been epidemic. During 1915, 39,837 rats were destroyed in Pnom-Penh.

Quang-Tcheou-Wan had 423 cases and 377 deaths during 1915; 198 of these cases, all fatal, occurred in Tong-San.

In *Laos*, as far as can be ascertained, only a single fatal case was reported during 1915, nor were any cases reported in *Tonkin*, which on the whole appears to have suffered less from plague than the other States of Indo-China.

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* Bulletin Mensuel, Office International d'Hygiène Publique, December, 1915.

There was a further reduction of the incidence of plague in Indo-China during 1916, the attacks falling to 772 and the deaths to 529. Of these, 117 cases (and 82 deaths) were referred to Annam, mostly in the Phaurang District. In Cambodge, at Pnom-Penh, 150 persons were attacked and 143 of them died. In Quang-Tcheou-Wan there were only 36 cases and 15 deaths during 1916.

The seasonal distribution of the plague cases and deaths in Indo-China during 1916 is shown in the following table :—

1916.	Plague Cases.	Plague Deaths.
January - - -	110	86
February - - -	95	67
March - - -	85	38
April - - -	141	79
May - - - -	104	64
June - - -	100	58
July - - -		46
August - - -	44	30
September - -	27	17
October - - -	27	14
November - -	24	18
December - -	15	12
	772	529

During 1917 plague was still prevalent in Indo-China and, up to the end of November, had caused 1,097 cases and 785 deaths, giving a fatality-rate of 71·6 per cent. These cases and deaths were distributed as follows :—

Tonkin—118 cases, 93 deaths, of which 107 (and 82 deaths) were in Haiphong.

Annam—323 cases, 193 deaths, of which 170 (87) were in Phantiet.

Cochinchina—323 cases, 198 deaths, of which 134 (74) were in Saigon.

Cambodge—300 cases, 276 deaths, of which 240 (173) were in Pnom-Penh.

Quang-Tcheou-Wan—33 cases, 25 deaths, of which 34 (23) were in Tchekau.

The seasonal incidence of plague in Indo-China in 1917 was as follows :—

1917.	Cases.	Deaths.
January - - -	82	66
February - - -	101	71
March - - -	97	70

1917.	Cases.	Deaths.
April	127	58
May	400	293
June		
July	69	45
August	50	44
September	34	30
October	36	34
November	19	14
December	82	60
Total	1,097	785

During the last seven years, 1911 to 1917, there have occurred in Indo-China 18,301 plague cases and 14,910 deaths, giving the high case mortality-rate of 81·5 per cent. The incidence of plague over the period is shown, year by year, in the table below :—

The Incidence of Plague in Indo-China, 1911 *to* 1917.

Year.	Cases.	Deaths.
1911	4,762	3,523
1912	3,488	3,188
1913	4,699	4,416
1914	2,373	1,658
1915	1,030	814
1916	772	529
1917	1,097	785
Total	18,221	14,911

CHINA.

Hongkong.—Since 1894 Hongkong has suffered annually from plague in varying amount. In 1914 the number of reported cases was 2,148 and the deaths 2,024, giving a case mortality rate of 94·2 per cent. During 1913 only 408 cases and 386 deaths from the disease were recorded. The great increase during 1914 was attributed by Dr. Francis Clark, the Medical Officer of Health, to the large amount of overcrowding among the Chinese population which followed upon the influx of many thousands of refugees from other parts of Southern China in consequence of the revolutionary disturbances that had taken place. When plague became severely epidemic, in April and May, about 60,000 persons fled in panic from Hongkong to other places on the mainland. There was a concurrent epizootic of plague among rats, and about 100,000 of these rodents were caught or found dead in the colony at one or another time during the year. Upon examination, 652 of them were found infected by the disease.

There was a considerable decline in the number of reported attacks and deaths from plague in Hongkong during 1915, for only 144 cases were reported, of which 140 had a fatal termination. Infected rats were discovered from time to time throughout the year, but not in very large numbers. The proportion of infected rats among 94,093 which were examined in the city itself was only 0·023 per cent.; while, among 15,816 rats examined on that portion (Kowloon) of the colony situated on the mainland, the proportion of infected animals was 0·48 per cent. Of the 144 human cases in the colony, 83 occurred in Kowloon (population, 73,100).

During 1916 sporadic cases continued to be reported in Hongkong, as also the discovery of infected rats. So far as can be ascertained, only 41 human cases and 39 deaths were recorded during the year. The number of rats found, on bacteriological examination, to be infected by plague was 52.

During 1916 a steamer arrived at Hongkong from Shanghai, all on board being well. It was moored at once alongside a rat-proof concreted wharf, and immediately underwent sulphur fumigation, after which six of the dead rats were examined and two were found infected by plague. No sickness or mortality among rats had been observed during the voyage.

During 1917 plague kept cropping up in Hongkong in sporadic fashion, but altogether only 44 cases and 35 deaths came under observation. As regards rats, many thousands were examined during the year, but only 32 were found by the bacteriologist to be infected.

The incidence of plague in Hongkong since 1895 up to the end of 1917 is shown in the appended table :—

Year.	Plague Cases.	Plague Deaths.	Case Mortality per cent.
1895 - - - - -	44	36	81·8
1896 - - - - -	1,204	1,079	89·6
1897 - - - - -	21	19	90·5
1898 - - - - -	1,320	1,175	89·0
1899 - - - - -	1,486	1,434	96·5
1900 - - - - -	1,078	1,022	94·8
1901 - - - - -	1,651	1,562	94·6
1902 - - - - -	559	552	98·7
1903 - - - - -	1,415	1,242	87·8
1904 - - - - -	506	493	97·4
1905 - - - - -	327	287	87·7
1906 - - - - -	893	842	94·3
1907 - - - - -	249	226	90·7
1908 - - - - -	1,073	986	91·9
1909 - - - - -	135	108	80·0

Year.	Plague Cases.	Plague Deaths.	Case Mortality per cent.
1910 - - - - -	25	23	92·0
1911 - - - - -	269	253	94·0
1912 - - - - -	1,847	1,768	95·7
1913 - - - - -	408	386	94·6
1914 - - - - -	2,148	2,024	94·2
1915 - - - - -	144	140	97·2
1916 - - - - -	41	39	95·1
1917 - - - - -	44	35	79·5
Total - -	16,887	15,731	93·1

The population of Hongkong in 1915 was estimated at 509,160.

During the summer of 1918, plague was prevalent in Hongkong and, from May to August, 232 cases and 123 deaths were reported. During the same period, 20 infected rats were found among many thousands examined.

Pakhoi.—This port, with a population of about 25,000, lies on the northern shore of the Gulf of Tonkin, and has long suffered from outbreaks of plague, being much exposed to its importation. In June two cases occurred in Pakhoi on board a steamer which had come from Hongkong, and about the same time it was reported that plague was epidemic in the hinterland near the two villages of Kan-lai and San-hü, in which more than a hundred persons died from the disease. In the port of On-pu situated 150 kilometres from Pakhoi, plague was also epidemic in June 1914, and several hundreds of people were carried off by the malady.

It was estimated that in 1913 over a thousand persons had died of plague in Pakhoi and its immediate neighbourhood.

During 1915 plague again appeared in Pakhoi in the month of June, but the number of persons attacked and the deaths have not been ascertained. No information has been received for 1916 or 1917 as to plague in Pakhoi.

Canton, which has a population of 900,000, and which lies 90 miles north-west of Hongkong, suffered from an epidemic of plague during 1914; and it is reported that no fewer than 1,481 persons were attacked. The epidemic was at its height in the early summer, but subsided in July. During May from 60 to 70 cases were admitted to the Chinese Charity Plague Hospital daily. Many cases were treated at their own homes, where, generally, they died; but it is not possible to state the total number of deaths caused by the disease during 1914 in Canton. It is said that a number of persons arrived from Hongkong already suffering from the disease. It is a recognised custom for sick Chinamen to try to reach their native towns if they are attacked by plague when away from home. In spite of the vigilance of the officers of the local steamers to prevent sick persons embarking for Canton from Hongkong, some managed, with the help of friends, to escape detection and some arrived in a moribund condition. Often plague patients made the journey from Hongkong to Canton by steam launch or on a native junk. It appears that anti-plague inoculation is year by year being more commonly used both by foreign and Chinese practitioners in Canton. Some early cases of plague were successfully treated with serum injections.*

The disease was present in May at Futshan, 30 miles from Canton, and it was also prevalent in Tungkan, Schuntag, Hokschan, and Tsang-sching.

During March and April 1914 the appearance of plague was reported at Chao-chow-fu, 185 kilometres north of Canton, but no details have been given. In 1915 and also in 1917 plague again appeared at Chao-chow-fu, but the number of cases and deaths has not been given.

During 1915 no reports were received as to the occurrence of plague in Canton; in 1916, however, ten fatal cases were reported, though the number of persons attacked has not been stated. There is no information as to the incidence of the disease in Canton during 1917.

Swatow, in the Province of Kwanglung, has a population of 70,000. As in former years, plague appeared in the spring of 1914 in this city and its neighbourhood, including the districts of Chaoyang, Huaping, and Sanhopa. The cases in Swatow itself were mostly in persons who had fled from other infected districts in the interior, bringing the disease with them. Plague subsided in June and no more was heard of it during the rest of the year. No figures are available to show approximately the extent of the prevalence in 1914.

In April 1915 plague re-appeared in Swatow and in the villages of the surrounding districts. In the city itself some 10 cases were reported, eight of them, all in one family, were of the pneumonic type; but the precise origin of this localised outbreak has not been traced, but it is probable the infection came from one or other of the villages near the city, where, as has been said, the disease had been appearing about the same time. Neither in 1916 nor in 1917 was anything heard of the occurrence of plague in Swatow, but early in that year plague was present at Chao-chow-fu, 26 miles from Swatow, in the Province of Kwangtung. An epizootic of plague among rats was reported about the same time at Hing-Ning, also in Kwangtung Province.

Amoy, in the Province of Fukien, has 114,000 inhabitants. Plague was again prevalent during 1914 in this city and its near vicinity, including the international settlement of Kulangsu.

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* Annual General Summary of Medical Reports from H.M. Consulates in China for the year 1914, edited by Dr. Douglas Gray, British Legation, Peking.

The early cases were noted in February and the disease continued to appear up to August. It is not, however, possible to give the number of cases and deaths, since the Chinese officials, if they themselves know, do not permit the information to reach the ears of Europeans. Plague was also present in certain towns and villages within 30 miles of Amoy, including Chinchow and Hwei-Ann.

In 1915 plague re-appeared in Amoy during April, and cases continued to occur up to mid August. During June the number of plague deaths was estimated at 40 a day, but by July the daily number of fatal cases had fallen to 10. As usual the Chinese officials of the city furnished no reports regarding the incidence of the disease. Cases also occurred during 1915 in Changchow and the presence of the disease in the international settlement of Kulangsu was reported in June.

In 1916 the disease was again present in Amoy from July to December, but no details of the prevalence have been reported. All that has been heard of plague in Amoy during 1917 is that it was present in the city and in the vicinity in the spring months, the local rats also being affected.

Foochow, like Amoy, is situated in the Province of Fukien, and has a population of 624,000. Plague was present in Foochow during 1914, and the mortality was said to be high, but no figures as to cases and deaths have been published. A number of cases were brought into the city from the neighbourhood, there having been severe epidemics of the disease in the up-country districts. In Foochow itself the infection was spread to some extent by the moving of infected families from one part of the city to another which was supposed to be more healthy. Prophylactic inoculation was in great demand, and much of it was carried out at the various mission and other hospitals.*

Nothing was heard of the occurrence of plague in Foochow during 1915, 1916, or 1917.

Shanghai, in the Kiangsu Province, has an estimated population of 534,300, of which 520,000 are Chinese and 14,300 foreigners. During 1914, some 26 cases of plague were reported, all Chinese, with 19 deaths. The first case occurred in April and, with the exception of 15 in October, the remainder were sporadic. In one instance it was proved that the infection had been contracted in Hangchow, which is 110 miles from Shanghai. Infected rats were found from time to time during the year, and out of 12,782 submitted for examination at the Municipal Laboratory, 186 were proved to be suffering from plague. Poisoned (phosphorus) baits were largely used, and altogether 180,792 rats were destroyed in 1914, against 166,333 in 1913. Of the rats examined in 1914, 70 per cent. were *Mus rattus*, the black or ship rat; the remainder being *Mus decumanus*, the brown or sewer rat. The majority of those infected belonged to the former variety. This rat in Shanghai makes its abode in the roof of the house, the presence of hollow ceilings and the use of Chinese tiles affording ample means of seclusion for these rodents, and constituting therefore a grave danger as regards the spread of plague.*

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* Annual General Summary of Medical Reports from H.M. Consulates in China, edited by Dr. Douglas Gray, British Legation, Peking.

During 1915, 12,618 dead rats were submitted to examination and 76 of them were found to be infected by plague. But only a single human case of the disease, believed to be imported, came under observation during the year, and this proved fatal. A total of 172,419 rats were destroyed in 1915, the proportion of *mus rattus* to *mus decumanus* being the same as that noted the previous year.

During 1914, 2,185 houses in Shanghai were made permanently rat-proof by laying solid ground floors, removing hollow spaces so as to deprive the rodents of shelter; 2,874 other houses were temporarily rendered rat-proof and treated with insecticides to kill off existing fleas. In 1915, 3,093 dwellings were made permanently, and 2,929 temporarily, rat-proof.†

A few plague-infected rats were discovered in Shanghai during 1916 and 1917, but so far as can be ascertained there were no human cases.

The following table gives the number of human plague cases, and the number of infected rats found in Shanghai from 1910 to 1915 inclusive :—

Year.	Human Cases.	Infected Rats.
1910	6	249
1911	—	138
1912	18	95
1913	10	122
1914	26	186
1915	1	76

At *Woosung*, the quarantine station for Shanghai, and distant from it about 11 miles, two cases of plague were landed on 12th May, 1914, from the s.s. *Korea*, which had come from Hongkong, where the disease was epidemic at the time.

On the Thibetan border of China an outbreak of pneumonic plague at Taochow was reported in September and October 1916 by a medical missionary stationed at Lanchow-Fu in the Province of Kansu. Twenty cases proved fatal, and it is stated that the infection was introduced from Me-an, a Thibetan monastery 33 miles from Taochow. The disease spread to Meichiochi. The medical missionary stated the outbreak began after a marmot, which had been found dead, had been skinned, cooked, and eaten. Every member of the household who had partaken of the flesh of this animal died of plague. He added that marmots are numerous in the locality, and that plague is endemic among them. It may be remembered that to this animal was attributed the origin of the disastrous epidemic of pneumonic plague which swept over Manchuria in the winter of 1910–11, though some experts challenged the truth of this statement.

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* Annual Report of the Health Department of the Municipality of Shanghai for 1914, by Dr. Arthur Stanley, Medical Officer of Health.

† Annual Report of the Medical Officer for Shanghai for the year 1915.

At the end of 1917 an outbreak of pneumonic plague broke out at the Fengchau railhead of the Peking-Kalgan line, 13 hours from the capital, and at the request of the Corps Diplomatique a commission of Chinese and foreign medical men under Dr. Wu Lien Teh, (Chief of the Manchurian Plague Medical Staff) was at once despatched to the spot, and all traffic on the railway was stopped. Inquiry showed that plague began first to appear on the Mongolian border of the Province of Shansi and spread southwards and eastwards from Mongolia into China, travelling along the lines of communication into the Provinces of Shansi and Chih-li. It was stated that at least 200 deaths were occurring daily. Later the infection spread southwards along the Peking-Hankow railway, threatening to penetrate into the very heart of China. The efforts of the medical commission to stop the spread of the disease were frustrated at the outset by the hostile attitude of the people, who were aided and abetted by the local government officials and by the military. The doctors were mobbed, and, at one time, were besieged for some hours at a railway station, so that finally they had to retire from the affected area. Their messages to the Government in Peking were not forwarded, and they were helpless to undertake any of the anti-plague work they had intended to do.

It was feared that this epidemic of pneumonic plague, beginning on the borders of Mongolia, might repeat the very disastrous experience of the winter of 1910–11, when, as may be remembered, a similar epidemic, beginning about the same time of the year, swept over Manchuria, killing more than 50,000 people in about three months. A report from an American source, dated 18th February 1918, states that the estimated number of deaths from plague in the vicinity of Paotongcheu, in the Shansi Province, from 14th January to 18th was about 1,000.

The Chinese Ministry of the Interior issued a statement that up to 22nd January 1918, the mortality from plague in the Shansi Province had been about 100, but the European medical men in Peking estimated the mortality to that date as being more than 5,000. The Province of Shansi is thinly populated, and therefore the spread of pneumonic plague was not so easy as in a more densely inhabited area. Later reports estimate the total number of the victims who succumbed to this epidemic of pneumonic plague at about 13,000, up to April 1918. As a preventive measure the passes along the Great Wall between North and South Shansi were closed. Another commission, under the direction of General Chiang-Chao-Ching, and including Dr. Smyly of the Union Medical College, and the Medical officer of the Japanese Legation, along with Dr. Tsurumi, a Japanese bacteriologist, were despatched in January 1918 to the scene of the plague outbreak in Shansi. On the security of the salt revenue surplus a loan of a million dollars was raised from the group banks to cover the expenses of the preventive measures.

No detailed report has as yet been published giving the extent of this outbreak, or the total number of cases and deaths.

Manchuria.—Plague was reported at Haranor in Manchuria about the end of August 1914 and, up to September, 16 persons—all of Russian nationality—had been attacked, 13 of them dying from the disease. Suspected cases were also reported in October by the Chief Medical Officer of the Chinese Eastern Railway Administration as having occurred 55 miles east of Manchuria Station; but, apparently, no epidemic followed. The recognised cases at Haranor were of the bubonic type, but in one instance a secondary pneumonia developed. This, however, was not attended by the development of any increased virulence of the disease such as happened in Manchuria and Mongolia in the disastrous winter of 1910–11, where the commencement of that epidemic was attributed by some to the occurrence of secondary pneumonia among the marmot trappers who had been attacked by plague, and who rapidly infected many of their fellow-workers.

Dr. Wu-Lien-Teh, in conjunction with Mr. F. Eberson, an entomologist, of the North Manchurian Plague Preventive Service, made some experiments as to the transmission of plague among marmots by contact with sick animals and feeding on plague corpses, the *spermophilus citellus*, a small species of marmot related to the tarbagan, being employed for the purpose. These animals are known to frequent graveyards, where they burrow into the ground. These little animals are very vicious and fight both with their teeth and their claws. The experiment related to (1) the inhalation of infection; (2) the susceptibility to infection by subcutaneous inoculation; (3) infection by feeding, and (4) histological examinations. The conclusions deduced from the experiments were as follows :—

(1) Of the marmots placed in contact with others already infected by plague, 52·6 per cent., by inhalation, developed pulmonary plague and died within four to six days.

(2) Marmots suffering from pneumonic plague are infective at an early stage of the disease, and animals which they infect acquire plague after a short incubation period.

(3) Pulmonary plague can be readily transmitted to these small marmots, and these when suffering from pulmonary plague are, in turn, capable of transmitting the same type of the disease through the respiratory passages.

(4) Septicæmic plague can be developed in marmots very easily as a result of respiratory infection, and also by direct subcutaneous inoculation.

(5) The marmot can acquire plague by way of the alimentary canal and by feeding on the carcases of animals that have died of plague.*

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* Dr. Wu's paper, published in the *Journal of Hygiene* for July, 1917.

JAPAN.

Plague occurred in comparatively small amount in Japan during 1914, for up to the end of the year only 83 cases and 70 deaths had been reported from the disease. The largest number of cases occurred in Tokio, where 47 attacks and 39 deaths came under observation. Yokohama had 24 cases, of which 20 had a fatal termination; infected rats being also discovered at that port during the year. Among other places reporting sporadic plague cases in 1914 were Hodagaya, Kobé, Ono-Mura and Kamasaki. In the province of Kanagawa, in July, the occurrence of pneumonic plague was reported, but no details were furnished. In Hiogo, during the early part of the year, 53 plague-infected rats were discovered.

During 1915, according to the Japanese official report for the year, there were only 20 cases of plague and 17 deaths; and, in 1916, some 77 cases and 65 deaths occurred in two prefectures—Mije and Aichi. A few of the cases were reported at Nagoya, a town of 400,000 population, about 170 miles west of Tokio. During 1917 only a single fatal case occurred at Yokkaichu (population about 27,000), some 25 having been attacked in the prefectures of Aichi and Mije. On the whole, it cannot be said that plague has done, comparatively, much harm in Japan during the last three years.

The following table gives the incidence of plague in Japan (not including Formosa) for 1907 to 1916:—

Year.	Cases.	Deaths.	Fatality rate.
1907 - - - - -	646	574	88·8
1908 - - - - -	347	280	80·7
1909 - - - - -	389	313	80·4
1910 - - - - -	49	41	83·6
1911 - - - - -	—	—	—
1912 - - - - -	—	—	—
1913 - - - - -	27	20	74·1
1914 - - - - -	83	70	84·3
1915 - - - - -	20	17	85·0
1916 - - - -	77	65	84·4
10 years - -	1,638	1,380	84·2

Formosa.—Every year since 1896, in which year the Japanese occupation of the island began, plague has occurred, sometimes in considerable epidemics, as may be seen in the table further on.

During 1914, 572 cases and 500 deaths were reported in Formosa, most of them being referred to the Kagi prefecture. In Taiwan, the capital of the island and one of its chief ports, plague came under notice in July, and the group of cases that occurred was of a virulent kind; the outbreak began in a brothel frequented by sailors from Amoy and Foochow, where plague was prevalent at the time. It is assumed that it was from this source that Taiwan received its infection. Some infected rats were found in the suburbs of this seaport town during August; and, in consequence, the Japanese authorities began a campaign and destroyed many of these rodents. Dr. Kuroki* has stated that, while admitting the propagation of plague in Formosa by rats, he estimates that a third of the human cases were caused by contact with inorganic matter contaminated with the plague bacillus, and he assumes that the number of cases in which plague is contracted through lesions of the skin must be large.

During 1915 plague was again prevalent in the Kagi prefecture, 77 cases and 68 deaths being reported. In 1916, there were only 5 cases, 4 of them fatal, at the port of Tamsui, where, in 1917, 9 more cases occurred, 6 of them having a fatal termination. A single fatal case also was reported at Shirin, making a total of 10 attacks and 7 deaths during the year. The disease appears to be subsiding in Formosa.

The following table shows the incidence of plague in the island of Formosa from 1896 to 1917:—

Year.	Plague Cases.	Plague Deaths.	Case Mortality per cent.
1896 - - - - -	258	157	60·8
1897 - - - - -	730	566	77·5
1898 - - - - -	1,233	888	72·0
1899 - - - - -	2,637	1,995	75·6
1900 - - - - -	1,079	807	74·8
1901 - - - - -	4,496	3,670	81·6
1 02 - - - - -	2,310	1,853	80·2
1903 - - - - -	886	708	79·9
1904 - - - - -	4,500	3,374	75·0
1905 - - - - -	2,398	2,100	87·6
1906 - - - - -	3,272	2,609	79·7
1907 - - - - -	2,592	2,241	86·4
1908 - - - - -	1,292	1,063	82·3
1909 - - - - -	1,026	841	82·0
1910 - - - - -	19	18	94·7
1911 - - - - -	377	329	87·3
1912 - - - - -	223	185	83·0
1913 - - - - -	136	125	91·9
1914 - - - - -	572	500	87·4
1915 - - - - -	77	68	88·3
1916 - - - - -	5	4	80·0
1917 - - - - -	10	7	70·0
Total in 22 years -	30,128	24,108	80·0

The population of Formosa in 1911 was 3,400,000.

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* Report of the Triennial Congress of the Eastern Association of Tropical Medicine, held at Saigon in 1913.

THE PHILIPPINE ISLANDS.

There was no epidemic of plague in the Philippines during 1914; but, in Manila, which has a population of 266,943, scattered cases were reported throughout the year, amounting in all to 26, of which 22, or 84·6 per cent., were fatal—against 20 cases and 11 deaths in 1913. The majority of the attacks reported in 1914 occurred in the early months of the year; 16 of them were Filipinos and 10 Chinese. In one part of the city where cases had occurred in January and February, 65 dead rats were found. During the whole year, 118,282 rats were caught by the authorities, and 29 were found to be plague-infected, while four others were regarded as "suspicious." As some of the early reported plague cases were close to premises occupied by an importer of Japanese goods, it was thought possible that infected rats might have been landed at Manila in packages from Japan. The possibility of imported infection is shown by the fact that several ships arrived, and landed members of the crew or passengers suffering from plague. For example, the s.s. "Taisang," from Amoy, arrived at Manila on 17th May, and a passenger from it was attacked by plague a few hours after landing, dying in the hospital three hours after his removal thither. The s.s. "Linan," from Amoy, reached Manila on 23rd May, and at the medical inspection a Chinese passenger was found to be ill of plague and was removed to hospital, where he died seven hours later. This same ship, at a subsequent call at Manila, in June, from Amoy, landed another passenger who died of plague at the hospital four days later. The s.s. "Rubi," from Hongkong, reached Manila on 15th May, and then went on to the port of Cebu, where one of the Chinese members of the crew was taken ill of plague on 20th May and removed to the local hospital.

The cessation of the occurrence of plague cases in Manila after the beginning of September is attributed to a heavy rainfall, with flooding of certain rat-infested localities; the rats were either drowned or driven to places where they could be caught and killed.

There appears to have been no human case of plague in the Philippine Islands during 1915; but at Manila, in June, three sick rats were caught and examined bacteriologically, one of them being found positive as regards plague. Altogether, 83,439 rats were destroyed in Manila during the year. During 1916 no human or rat plague was discovered. From January to September, 25,000 rats were examined without a single infected animal being discovered; and, in the first quarter of 1917, of 26,895 rats examined, none were found to be infected nor, in 1917, did any evidence of plague in man or rat appear during the rest of the year. Careful watch was kept on ships arriving from Chinese and Japanese ports, and the campaign against rats was continued, many thousands being killed.

NEW CALEDONIA.

Plague appeared in New Caledonia during the early part of 1914, in the *arrondissement* of Ouegoa at the village of Bondé, where 11 fatal cases came under official observation. Ouegoa is about 300 kilometres north-east of Noumea, the capital of the colony. In addition to the 11 fatal cases just mentioned, 14 other deaths from plague occurred in 1914 among the Pamboas tribes, and 18 more among the Foa, Noueo and Northern tribes. So far as can be learned, there were at least 45 cases and 40 deaths ascribed to plague in New Caledonia during 1914, all of them in the first quarter.

In the previous year a small outbreak of the disease was reported at Bourail, 150 miles from Noumea, where in 1912 more than 60 persons had been attacked, and the local rats had been shown to be infected. Precise details of the 1914 cases have not yet been published.

During 1915 and 1916 no cases of plague appear to have occurred in New Caledonia; but in April 1917 a single fatal case was reported, the infection having taken place, it was said, in a bacteriological laboratory at Noumea. No details of this incident have as yet been received; the victim probably was working with plague cultures during an investigation, such instances of contracting plague in a laboratory being not uncommon.

THE HAWAIIAN ISLANDS.

A few sporadic cases of plague were reported during 1914 in the Hawaiian Islands, namely, 2 at Honolulu, 1 fatal; 2 cases and 2 deaths at Honokaa; 1 fatal case at Paauhau, and 1 also fatal at Kakuihaele. Occasionally, infected rats were found at Hilo and Kakuihaele, but only in isolated instances. The last human case was reported in mid-August, and the last infected rat at the end of that month. Altogether, there were 6 human cases and 5 deaths during 1914. In 1915, 4 cases and 3 deaths from plague were recorded, 1 in October at Paauilo, 1 in November at Kukaiaie, and 2 in December—1 of which was at Honokaa and 1 at Paauhua. About 10 infected rats were discovered during 1915 among the many examined at the Hilo bacteriological laboratory. During 1916, 7 infected rats were discovered, 6 at Hilo and 1 at Paauilo; but no human cases appear to have come under observation.

In 1917, 5 cases of human plague, all fatal, were reported: 3 at Paauhua and 2 at Kukaiaie, the first group in January and the second in September. One of the victims in the first group was a Japanese rat-trapper. Nine infected rats were found, namely, 3 at Paauilo, 3 at Paauhua, 3 at Kukaiaie.

Plague has been present in the Hawaiian Islands since 1900, during which period of 18 years 305 cases and 275 deaths have been recorded. It is believed that plague was introduced into the Hawaiian Islands by ship rats in bundles of hay from the port of San Francisco in 1900. The following table gives, year by year, the number of cases and deaths from 1900 to 1917. The population of the islands in 1910 was 191,905 :—

Year.	Plague Cases.	Deaths.
1900	71	61
1901	23	20
1902	44	41
1903	25	24
1904	5	4
1905	16	14
1906	22	22
1907	26	22
1908	22	22
1909	8	4
1910	12	12
1911	4	4
1912	8	8
1913	4	4
1914	6	5
1915	4	3
1916	—	—
1917	5	5
Total in 18 years	305	275

Calculated on these figures, the case mortality-rate was 90·1 per cent. This high fatality suggests that, possibly, non-fatal cases were sometimes concealed.

On 5th May 1918 a fatal human case of plague occurred at Laupahoehoe, Hawaii, and on the 18th of the same month an infected rat was discovered.

UNITED STATES.

California.—During 1914 a single case of plague was reported in California at Walnut Creek, Contra Costa County, where of late years infected ground squirrels (*citellus beecheyi*) have been discovered from time to time, and in which county during 1914 some 38 infected animals were found. Since 1908, when these ground squirrels were first recognised by Dr. Rucker, now Assistant Surgeon-General of the U.S. Public Health Service, to have an enzootic of plague, sporadic human cases have been recorded in the counties of California in which infected animals had been detected. The history of these human cases has been generally that they had handled ground squirrels while hunting, or while skinning them. Altogether since 1908 about 1,957 infected animals have been reported in nine Californian counties.

The following table gives, for each of the three years 1912–13 and 14, the number of ranches hunted over, the number of ground squirrels killed, the number of ranches found infected, the number of plague-infected animals discovered, and the percentage of animals infected, in California.*

Year.	Ranches hunted over.	Number of Ground Squirrels killed.	Number of Ranches infected.	Number of Ground Squirrels found infected.	The Percentage of infected Animals.
1912 -	1,727	29,144	86	902	3·0
1913 -	1,839	22,464	68	419	1·9
1914 -	2,506	22,900	21	69	0·3

It is estimated that over 20 millions of ground squirrels have been destroyed of late years in California by the systematic methods adopted for the purpose; and during that period the infection of 11 persons has been attributed to the handling of these animals. The five counties in which the ground squirrels have been most affected are Contra Costa, San Benito, Alameda, Santa Clara, and San Joaquin. Apart from the plague danger, farmers, ranchers, and landowners hail with satisfaction the destruction of ground squirrels, which prey upon the crops and pastures, burrow holes in irrigation channels and canal banks, and otherwise inflict much trouble and expense upon the agriculturist.

Plague first appeared in California in 1900, and again in 1904. In 1907 it re-appeared in San Francisco, where it continued till 1908, attacking 159 persons; and during the same period 15 other cases occurred at the town of Oakland. From August 1907 to October 1908, 398 infected rats were found in San Francisco, and 125 at Oakland. It is believed that the ground squirrels were first infected by rats in the vicinity of these towns, both of these animals sometimes living side by side in the same burrows, so that transfer of infection by fleas would be easy.

So long as this plague enzootic exists in California among the ground squirrels, there is danger of a human plague epidemic developing in the State.

During 1915, in the month of July, a fatal case of human plague occurred at Concord, Contra Costa County, in the person of a Greek male, aged 21, who was removed to hospital, where the diagnosis was bacteriologically confirmed. Infected ground squirrels were found during the year in the following counties, namely, Contra Costa, San Benito, and Alameda.

In 1916 about 100 plague-infected ground squirrels were discovered in several counties during the first half of the year, particularly in Alameda, Contra Costa, San Benito, Monterey, Santa Clara, San Mateo, Merced, and Santa Cruz; but no human cases were reported. Some suggestion is made by American medical authorities that the plague infection is gradually progressing among the ground squirrels towards San Francisco.

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* *Vide* "Plague Eradication in California," by Surgeon J. D. Long, U.S. Public Health Service, in Public Health Reports for November 20, 1914.

During 1917, from March to July, 42 infected ground squirrels were found in five counties, namely, San Mateo, San Francisco, Santa Cruz, Alameda, and San Benito. So far as can be ascertained, no human plague cases came under observation during 1917; but the fact that enzootic plague among ground squirrels has extended across the border of San Mateo county into that of San Francisco, seems to support the suggestion that the infection is gradually drawing nearer to the city of San Francisco.

From 1st June to 2nd July 1918 17 plague-infected ground squirrels were detected in Alameda, Contra Costa, and San Mateo counties.

Seattle is the capital of King's County, in the State of Washington, and is situated on an arm of Puget Sound; it ranks next to San Francisco among the Pacific ports of the United States, and its population is about 237,000. So far as is known, no human cases of plague were reported in Seattle during 1914.

In October 1907 seven deaths from plague were recorded in this town, but, with the exception of a suspected case in December 1913, no others have been discovered since that time. From the end of 1907 to the end of 1914 infected rats have been found each year (except 1909 and 1912), but not in any great numbers, 26 being discovered in 1913 and the same number in 1914, but only four in 1915. The continued finding of plague-infected rats at this port is not without significance, and may ultimately lead to serious developments under certain conditions. It may be mentioned that one of the infected rats found in 1915 was contained in a package of plants consigned from Yokohama to Seattle, and was discovered in the box when opened. It was killed and taken to the laboratory for examination, unmistakable evidence of plague being discovered.

The examination of rats in Seattle was continued throughout 1916, but none of those examined was found to be infected. In March 1917 a single plague-infected rat was discovered in Seattle during the month of March, and later three others were found during the same month at the Pike Place Market in that town, but apparently there were no human cases during the year.

New Orleans (population, 340,000).—In 1912 a single plague-infected rat was found at the port of New Orleans, the chief city in the State of Louisiana, situated on the banks of the Mississippi River. But doubts were at the time expressed as to the correctness of the diagnosis. Nothing more was heard of the disease in this port until June 1914, when a Swedish sailor, who had only been 12 days in the city, was attacked by plague, followed by a second case the next day, this patient being a white man who had occupied a room next door to that in which the Swedish sailor had been sleeping at the "Home of the Volunteers of America." A third case, a negro boy, developed a few days later. A succession of scattered cases continued to be recorded up to the end of the year, the total observed attacks numbering 30. Almost simultaneously with the appearance of human plague in New Orleans, the presence of the disease among rats was discovered. At once systematic measures for the destruction and examination of these rodents was instituted, and by the end of December the total number of rats destroyed amounted to 215,231; of these, 183,513 were submitted for examination and 219 were found to be infected. Some of the rats examined towards the end of 1914 were found to be suffering from chronic plague, and such animals were also found in the suburbs of New Orleans. As soon as the occurrence of plague was reported, Surgeon-General Blue, of the U.S. Public Health Service, at the instance of the Secretary of the Treasury for the United States, was despatched to New Orleans, accompanied by a staff of medical and sanitary experts, to take over the charge of the outbreak. Infected premises were ordered to be evacuated, the inhabitants being removed to temporary quarters; infected buildings were disinfected by fumigation: and 188 men were engaged to carry out the campaign against rats. Rules for effective rat-proofing of houses were drawn up, and drafts submitted to the city authorities for enforcement. The sick were isolated and contacts dealt with. These and other measures seem to have been successful in preventing plague from becoming epidemic among the population of New Orleans. The fact that the disease has established itself among the local rats has caused some anxiety; and until this is extinguished it must remain a menace to the inhabitants of the city. In July 1914, with a view to prevent the spread of plague overland and overseas from New Orleans, arrangements were made for fumigating all outgoing ships, to free them of rats. The overland freight inspection of cars was instituted to determine whether they were rat-free and in rat-proof condition. Loading was conducted under supervision, the cars were sealed with lead seals, and labelled to the effect that they had been inspected and passed as rat-free. In the town, special precautions were taken to maintain the municipal markets free from rats. Careful attention was also devoted to the removal and disposal of garbage, so as to deprive rats of this source of food, and to render the trapping of these animals easier.*

It is difficult to decide from what source this outbreak originated and whether the plague detected in New Orleans in June 1914 was due to a recrudescence of the 1912 infection, the only evidence of which was the finding of a single infected rat; or whether, on the other hand, it was really due to a fresh strain of infection imported from Cuba or some other place where the disease had been occurring.

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* U.S. Public Health Reports for 24th July, 1914.

During 1915 only two human cases of plague were discovered in New Orleans, one in August and one in September. Altogether 344,412 rats were destroyed in New Orleans during 1915; of these, 131,430 were examined, and 53 were found to be infected by plague. In addition a considerable number of other rats were classed as " suspicious."

The special measures which have been carried out at New Orleans to combat plague since 1914 were: (1) attempts to eradicate as far as possible the rat-population; and (2) the rat-proofing of docks, warehouses, and other buildings, together with all the usual measures that are applicable generally to prevent the disease.*

During 1916 large numbers of rats were caught in New Orleans week by week, and examined for the presence of plague. Up to November 11th, 922,242 had been collected and of these 394,993 had been examined, and 346 discovered to be infected. On 29th December a plague-infected rat was trapped at a public " dump," and on 4th January 1917 another was caught at a New Orleans grain elevator. On 3rd April 1917 a dead rat was picked up and upon bacteriological examination was found to be plague-infected. So far as is known there was no further case of plague in rats or man during the remainder of 1917.

COLOMBIA.

The Republic of Colombia occupies the north-west corner of the South American Continent, having a population of about four millions. In a report issued by the Health Department of Baranquilla, the chief port of Columbia, situated on the Magdalena River, 15 miles from its mouth, it was stated that from December 1913 to May 1914, cases of infectious pneumonia had been occurring at Usicuria, Sabanalarga, and Isabel Lopez, and that plague bacilli had been found in the cultures obtained from the sputum of some of the cases. Instances of the same sort had also been observed in Baranquilla, as also at some places along the northern coast of Colombia, during the past 12 months. In May 1914 plague was reported to be present at Tumaco, a Colombian port on the Pacific coast not far from the Ecuador frontier, and at Santa Marta, a port on the Caribbean Sea. Details of these outbreaks, however, have not been obtained. It is alleged that inquiries into the cases of infectious pneumonia along the Colombian coast had been made by members of the medical staff of the Panama Canal zone, and that the opinion had been expressed that these cases were not true plague. It may be mentioned that in the previous year cases of suspected plague were reported at Santa Marta and at Puerto Colombia, though the diagnosis at the time was disputed. The occurrence of plague in Colombia is not improbable, since there were opportunities for importation of the infection from the adjoining Republics of Venezuela on the east and Ecuador on the south, in both of which States plague was prevalent at the time.

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* U.S. Public Health Reports for May 26th, 1916.

No information has come to hand as to the occurrence of plague in Colombia during the years 1915, 1916, and 1917.

ECUADOR.

Since 1906 plague has been appearing in Ecuador, chiefly in Guayaquil, its capital, with a population of about 55,000, a seaport town which hitherto had the reputation of being one of the most insanitary places on the west coast of South America. During 1914, according to a report by Dr. Becerra, Director of Public Health for Guayaquil, there occurred in that town 409 cases and 158 deaths, as compared with 718 cases and 296 deaths in the previous year. Many of the cases in 1914 were treated in hospital by the inoculation of anti-plague serum; and it is claimed that, after excluding all cases that survived less than 24 hours after admission to hospital—that is, eliminating the moribund cases which no treatment could benefit—the case mortality-rate in the serum-treated cases was only 25 per cent., against a rate of 38·6 per cent. for all cases during the year.

According to the testimony of American plague experts from the Philippine Islands, who have studied the disease in the Far East, the type of plague met with in Guayaquil appears to be much milder than that observed in India and other Oriental countries.

Besides Guayaquil, other places in Ecuador yielded plague cases during 1914, and among them were Duran, Yaguachi, San Borodon, and Milagro.

In 1915 plague continued to be prevalent in Guayaquil, 379 cases and 149 deaths being recorded.* The incidence was almost altogether limited to the first three months and the last two months of the year. During November an unusual mortality among rats was observed in the town, and it is stated that fleas were noticed to be more numerous than usual. Some scattered plague cases were reported in Duran and Aqua Piedras during 1915.

It has been remarked that if plague incidence increases in the two last months of the year, a greater prevalence of the disease will be observed in the early months of the coming year. In this instance, this observation proved true, for in Guayaquil during the first three months of 1916 the disease was epidemic and continued to occur throughout the year, becoming again severely prevalent in November and December. The total cases reported in Guayaquil during 1916 amounted to 976 and the deaths to 319.†

During May 1916 plague spread into the interior of Ecuador, behind the coast towns of Bahia and Manta, and across the Andes to Ambato, situated at an elevation of 7,000 feet above sea-level, and having a population of 130,000. Cases were also reported at Duran, Babahoyo, Danle and Santa Rosa.

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* A later report in the *Bulletin of the Office International d'Hygiène Publique* for September, 1916, gives the total plague cases for 1915 as 328, and the deaths 134.

† Another source of information gives the number of plague deaths during 1916 as 346.

Plague continued to appear in Guayaquil during 1917—553 cases and 152 deaths being recorded. A few cases also occurred at Duran, Milagro, Taura, Salitre, Nobol, and Naranjal; but no details of these occurrences in 1917 have as yet been received.

The seasonal incidence of plague in Guayaquil during the four years 1914, 1915, 1916 and 1917 is shown in the next table :—

The Seasonal Incidence of Plague in Guayaquil during 1914, 1915, 1916 *and* 1917.

Month.	1914.		1915.		1916.		1917.	
	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.
January -	57	23	74	28	187	70	161	43
February -	17	11	40	18	151	67	103	31
March -	8	4	16	12	119	37	69	20
April -	2	—	—	—	48	13	23	5
May -	3	1	1	—	11	2	8	1
June -	3	2		—	11	3	1	—
July -	1	1	3	—	15	4	3	—
August -	8	1	—		16	5	—	—
September -	15	5	1	—	29	8	4	1
October -	45	11	9	4	52	14	22	8
November -	111	47	47	16	108	35	49	15
December -	139	52	188	71	229	61	110	28
Total -	409	158	379	149	976	319	553	152

During these four years, 2,317 cases of plague were reported, of which 778, or 33·6 per cent., had a fatal termination.

The figures as to number of attacks and deaths are available from 1908 to 1917, and these are given in the next table :—

The Incidence of Plague in Guayaquil, 1908 *to* 1917.

Year.	Cases.	Deaths.	Case Mortality-rate per cent.
1908 - - - - - -	501	238	47·5
1909 - - - - - -	827	302	36·5
1910 - - - - - -	665	262	39·4
1911 - - - - - -	932	263	28·2
1912 - - - - - -	475	177	37·2
1913 - - - - - -	718	296	41·2
1914 - - - - - -	409	158	38·6
1915 - - - - - -	379	149	39·3
1916 - - - - - -	976	319	32·7
1917 - - - - - -	553	152	27·5
Total in 10 years -	6,435	2,316	36·0

The prevalence of plague in Guayaquil was continued during the first half of 1918, in which period 354 cases and 94 deaths were reported, giving a case mortality-rate of only 26·5 per cent.

PERU.

During 1914, 760 cases of plague were reported in the State of Peru, of which 386, or 50·8 per cent., proved fatal. The largest number of the cases—335 (176 deaths)—were referred to the Department of Libertad. The disease was most prevalent in the early months of the year. Among the particular places affected by plague during 1914 were the ports of Trujillo, Salaverry, and Pascamayo, in the Department of Libertad; the port of Mollendo in the Department of Arequipa; and at Callao, the port for Lima, the capital of the Republic.

In 1915, the total number of officially reported cases was 455, of which 240, or 53 per cent., were fatal. The departments which suffered most during the year were Libertad, Lambayeque and Lima.

During 1916 a slight increase in the number of plague cases in Peru was observed, 510 attacks being recorded, with 267 deaths. The Department of Libertad again had the largest number of cases, namely, 129, 76 of which had a fatal termination. The plague prevalence of 1916 was confined to the maritime provinces, except that in the inland Department of Cajamarca a few cases were recorded. A number of cases came under notice during 1916 at the northern port of Paita, in the Department of Piura. In a report made to the Canal Zone Health Department it was observed that "Plague in Peru seems to be steadily increasing, and an unusual number of cases have appeared at Paita. In view of no eradicative measures being taken in any of the west coast ports, plague will, in all probability, make further extensions northwards and southwards."

In the first half of 1917, 358 cases of plague were reported, but the number of deaths has not yet been reported. More recent reports give, for the whole of 1917, a total of 414 cases and 211 deaths from plague in Peru. Taking the four completed years 1914, 1915, 1916, and 1917 the total for the period was 2,139 cases and 1,104 deaths. The Department that seems to have suffered most was Libertad, in which, during these four years, 800 cases and 410 deaths occurred; Lima being next with 390 cases and 192 deaths; Lambayeque third, with 318 attacks, 127 of which were fatal; and Piura fourth, with 242 cases and 164 deaths.

The distribution of the plague cases and deaths over the eight Departments of Peru during 1914, 1915, 1916 and 1917 is shown in the following table :—

The Incidence of Plague in the Departments of Peru, 1914, 1915, 1916, *and* 1917.

Departments.	Population.	1914.		1915.		1916.		1917.	
		Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths
Ancachs	428,412	34	20	8	6	62	21	5	3
Arequipa	229,007	54	24	23	15	24	19	39	23
Cajamarca	442,412	16	7	—	—	2	—	—	—
Callao	43,118	14	8	39	13	40	22	29	15
Lambayeque	124,091	107	47	102	38	90	34	19	8
Libertad	250,931	335	176	123	63	129	76	213	95
Lima	298,106	106	48	104	63	85	37	95	59
Piura	213,909	94	56	56	42	78	58	14	8
Total	—	760	386	455	240	510	267	414	211

The Departments of Ica (population 90,962) and Moquegua (42,694) reported no plague cases during the above four years.

As regards the seasonal occurrence of plague in Peru, the disease appears to reach its maximum each year during the first three or four months of the year. The monthly returns for 1915 are incomplete for the second half of the year. So far as the reports have been received during the last three years, the results are shown in the appended table, which gives month by month the number of plague cases and deaths reported in Peru :—

The Seasonal Incidence of Plague in Peru during 1914, 1915, *and* 1916.

Month.	1914.		1915.		1916.		1917.	
	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.
January	196	95	122	62	44	27	The monthly returns for 1917 have not yet been received.	
February	107	42	79	42	113	57		
March	100	59	23	11	71	32		
April	62	35	27	14	65	40		
May	18	7	19	8	46	21		
June	23	8	8	3	21	14		
July	16	11	177	100	20	14		
August	22	19			7	3		
September	18	7			19	6		
October	46	24			8	3		
November	59	32			39	23		
December	93	47			57	27		
Total	760	386	455	240	510	267	414	211

Plague has been present in Peru since 1903, and from the official returns it appears that, up to the end of 1916, it had attacked 11,511 persons, of whom 5,925, or 51·5 per cent., died. The disease seems to have become endemic in Peru. The next table gives for each year, from 1903 to 1916, the number of persons attacked by plague in Peru, the number that died, and the case mortality-rate per cent. As has been said, the complete returns for 1917 have not yet been received :—

Plague in Peru 1903 *to* 1917.

Year.	Cases.	Deaths.	Case Mortality per cent.
1903 - - - - -	172	90	52·3
1904 - - - - -	940	469	49·9
1905 - - - - -	775	421	54·3
1906 - - - - -	641	331	51·6
1907 - - - - -	1,170	731	62·5
1908 - - - - -	1,691	872	51·6
1909 - - - - -	999	492	49·2
1910 - - - - -	790	289	36·6
1911 - - - - -	889	428	48·1
1912 - - - - -	840	443	52·7
1913 - - - - -	879	459	52·2
1914 - - - - -	760	386	50·8
1915 - - - - -	455	241	53·0
1916 - - - - -	510	267	52·3
1917 - - - - -	414	211	50·9
Total in 15 years - -	11,925	6,130	51·4

The population of Peru in 1906 was 4,559,550.

The Surgeon-General of the United States Public Health Service, in his Annual Report for the fiscal year ended 30th June 1917, in discussing the subject of quarantine, remarks : " Practically every seaport in Peru must be regarded as plague-infected."

From 16th February to 31st March 1918 the total number of plague cases reported in Peru was 113, of which 68 occurred in the Department of Libertad, 22 in Lima, 16 in Lambayeque, 5 in Ancachs and 1 each in Junin and Callao. During May 1918, 2 cases of plague were reported at the port of Callao on board the s.s. " Quilpue," but where the infection was contracted has not been stated.

CHILI.

Trustworthy information regarding the incidence of plague in the Republic of Chili during 1914 is scanty in amount and difficult to obtain, as has been the case also in previous years. From reports sent to this country by the British Consul at the port of Iquique, which has a population of 45,000, it appears that, during the first quarter of 1914, about 25 persons were attacked by plague in that town, and that 15 of them died. In 1913 there had been 63 cases and 24 deaths recorded from the disease in Iquique. In the early months of 1914, scattered cases, six in number and all fatal, were heard of in Santiago, the capital of Chili and having about 360,000 inhabitants. Plague had been also present in this city during the previous year. In the Annual Consular Report for 1914 on the trade of the port of Antofagasta (population, 32,000), it is remarked that, though plague had not been epidemic, it was always existent in the town. There is reason to believe that this malady has been more prevalent in the Republic during 1914 than the above fragmentary details would appear to indicate, and the same remark applies to the records of previous years. From the beginning of 1907 to the end of 1913 the officially reported plague cases and deaths in Chili numbered, respectively, 716 and 287, but this is more than probably an understatement. The infection seems to be endemic in certain towns, such as Iquique and Autofagasta. The population of Chili is said to be a little more than five millions.

The only information received concerning the incidence of plague in Chili during 1915 comes from Coquimbo (or La Serena), with a population of 16,000, the capital of the province of Chili and situated near the mouth of the River Coquimbo. In this town two plague cases were reported in August, but, beyond the mention of the occurrence, no other details have been given.

In 1916 plague appeared again in Antofagasta in a section of the city containing a number of small stores and restaurants. None of the cases occurred near the docks or wharves. Infected rats were found, and it is said that the existence of rat plague had been recognised for a considerable period. Altogether, 10 cases were notified, including one imported case which arrived on a ship from Iquique. Another outbreak was reported at Tacna, with a population of 10,000, the capital of the province of that name, eight cases being observed. Plague cases also came under notice at Mejillones and at Tocopilla. A report of the Panama Canal Zone Health Department in 1916 states that "plague is increasing along the west coast of South America. The occasional reports of the disease in Chilian ports requires our considering all ports in this country north of Valparaiso as infected." It is probable that the above-mentioned outbreaks do not show the true amount of plague that occurred in Chili during 1916.

During March 1917 eight plague cases were reported at Antofagasta, and some cases were also observed at Tacna, where the disease had been present in the previous year. From a report published in the *Buenos Aires Herald* of 18th February 1917, plague had appeared about that time at Sama, 28 kilometres from Tacna. Since then no further information has been available.

ARGENTINA.

From an official report published by the Argentine Government for the first half of 1914, it appears that 130 cases of plague had been recorded, 45 of them being referred to the Federal Capital of the State, Buenos Aires (population, 1,320,000), but the number of deaths is not given. The remaining cases were distributed as follows among the various provinces :—Santa Fé, 26 cases: Cordoba, 26; the Province of Buenos Aires (not including the city), 13; Salta, 9; Jujuy, 7; Corrientes, 3, and Tucuman, 1. As regards the distribution of the plague cases, month by month, during the first half of 1914, there were 24 cases in January, 20 in February, 20 in March, 29 in April, 17 in May and 20 in June. Unfortunately, it is not possible to give any figures as to plague in the second half of 1914, as no information has been received.

No mention is made, in the official report quoted above, respecting plague infection among rats at Buenos Aires or in any of the provinces; but, as accounts are published from time to time of the discovery of plague-infected rats at European ports on board ships which have just arrived from Argentina and the River Plate, it is almost certain that plague is enzootic in some, at least, of the ports of that country. The human disease may be said to be endemic in Buenos Aires and elsewhere.

In 1913, from the *Anales del Departamento Nacional de Higiene*, it appears that 120 deaths from plague had been reported in Argentina population (about 7,000,000).

Although no direct admissions have been made by the Argentine authorities, it is generally believed that plague has been occurring in the Republic for some years and that the fact has been concealed as far as it was possible to do so. Only 8 deaths from plague in 1911, and 14 in 1912, were officially admitted.

No official report has been received for 1915; but, from other sources, it appears that a single case occurred in Buenos Aires in September. But, early in 1916, statements appeared in the *Buenos Aires Herald* and in the *Buenos Aires Standard* to the effect that several small towns in the province of Cordoba were suffering from a malady believed to be plague and that at Alejandro, for example, nine persons were at that time ill of the disease. The provincial authorities, it was asserted, had not taken effective steps to stop the spread of the malady.

From a communication published in the *Nacion* in April 1916, it appears that, in December 1915, plague was occurring in several places in the province of Cordoba, especially in Las Perdices and Cabral. Early in January 1916, cases were also reported at La Laguna and Ausonia. Besides the places already mentioned, plague occurred at Las Liebres, Corral de Bustos, Arroyita, and Villa Maria. Altogether, 49 persons were known to have been attacked and 11 of them had died. It was alleged that all information had, as usual, been withheld by the officials concerned as to the prevalence of plague, until they were able to state that the prevalence had subsided and that no cases then existed in the Republic.

In September 1916 plague appeared in Villa Urquiza, a town situated in the Argentine province of Entre Rios, and caused some deaths.

In the *Anales del Departamento Nacional de Higiene* for December 1916, the incidence of plague in recent years in Argentina was discussed, and the following figures were given:— In 1899, 40 cases were reported, and, in 1900, 238. In the period from 1901 to 1912 about 100 cases, on an average, were annually recorded. In 1913 there were 504 plague cases (and 139 deaths); in 1914, 216 (51); in 1915, 84 (8), and in 1916, up to April, 57 cases came under observation. A report published in the *Buenos Aires Herald* of 23rd March 1917 stated that cases of plague had been occurring then in the City of Buenos Aires as well as in the Province of Salta. The latter outbreak originated in La Sallita, where " the hovels have been burned and the inhabitants supplied with tents." In March, according to the *Buenos Aires Standard*, " a grand *battue* of rats is in progress " in that city.

URUGUAY.

Montevideo.—Scattered cases of plague have been occurring in Montevideo (population, 300,000), the capital of Uruguay, for some years. From 1901 to 1909, inclusive, about 76 cases came under observation, 23 of them occurring in 1908. During 1911 four cases, two of the pneumonic type, were reported. Cases in small numbers were reported in 1912 and in 1913. During 1914 only two cases appear to have occurred; one in 1915, and two in 1917. The following table gives the number of cases and deaths reported in Montevideo from plague from 1901 to 1917:—

Plague in Montevideo, 1901 *to* 1917.

Year.	Plague Cases.	Plague Deaths.
1901	4	3
1902	8	6
1903	3	—
1904	7	5
1905	2	—
1906	6	2
1907	19	7
1908	23	8
1909	4	1
1910	—	—
1911	4	4
1912	4	1
1913	9	2
1914	2	—
1915	1	—
1916	—	—
1917	2	2
	98	41

Reckoned on the above figures, the case mortality-rate was 42·8 per cent. In the *Boletin del Consejo Nacional de Higiene* (Vol. XII., No. 124, February 1917), Dr. E. Fernandez Espiro discusses the incidence of plague at Montevideo. He states that, in spite of all attempts, the origin of plague at Montevideo has not been ascertained, but it was probably imported. Undue mortality among rats was first observed in 1901, in the neighbourhood of the Customs Buildings, before any human cases had been discovered. On one occasion the reappearance of plague, after an interval of freedom from the disease, occurred on board a ship in the port; labourers who had handled sacks coming from Asuncion (Paraguay) developed plague. The cases have been mostly of the bubonic type. The chief sufferers have been Customs employees, workers in flour mills, bakeries, provision stores, grain warehouses, forage stores, stables and distilleries. The majority of the cases have been observed in the autumn months, but some occurred in the spring and winter. No epidemic has developed notwithstanding the continued presence of the human disease in Montevideo and the prolonged period of time during which rats have been infected in the city. No information is available as to plague in the Republic of Uruguay, outside Montevideo.

PARAGUAY.

There is no information as to the occurrence of plague in Paraguay during 1914. In February 1915 some cases believed to be plague were reported in Asuncion, the capital of Paraguay, situated on the Paraguay River, and which is in constant communication with Buenos Aires by steamer. No official report on these cases has appeared, nor was such a communication expected from the local authorities, who have been notorious in the past for their policy of concealment in respect of plague and other infectious diseases. There is a general opinion locally that plague has probably been occurring in sporadic form during the last 15 years, and that it may be regarded as now endemic in Asuncion. It may be remembered that in 1911, 23 cases were reported in that city, with 14 deaths, and that in 1912 the disease again appeared in the poorest districts of Asuncion, though the fact was concealed by the local officials at the time. No information has been obtained as to the incidence of plague in the city during 1916 or 1917.

BRAZIL.

Since 1900 Brazil has suffered from plague, particularly in Rio de Janeiro and other large towns; but recent years have shown a marked reduction in the number of cases and deaths.

Rio de Janeiro (population in 1911, 921,987).—In this city, the capital of Brazil, only four cases, with three deaths, were reported during 1914; against 24 attacks, 12 fatal, in 1913. During 1915, 12 cases were observed, of which six died; neither in 1916 or 1917 did any instance of plague come under observation. For the 15 years ended December 1915 plague had been annually appearing in Rio de Janeiro, and altogether 3,888 attacks and 1,829 deaths had been registered, giving for the whole period a case mortality-rate of 47·1 per cent. In 1905 an active compaign against rats was instituted and steps were taken to render houses rat-proof. Since that date there has been a gradual diminution in the number of reported plague cases.

The following table gives the number of cases and deaths, year by year, in Rio de Janeiro, from 1900 to 1917 inclusive, and shows also the case mortality for each year.

Plague in Rio de Janeiro.

Year.	Cases.	Deaths.	Case Mortality per cent.
1900 - - - - -	516	295	57·2
1901 - - - - -	384	199	51·8
1902 - - - - -	461	215	46·6
1903 - - - - -	792	360	45·5
1904 - - - - -	682	292	42·8
1905 - - - - -	353	142	40·2
1906 - - - - -	241	115	47·7
1907 - - - - -	159	73	45·9
1908 - - - - -	117	54	46·2
1909 - - - - -	40	15	37·5
1910 - - - - -	38	18	47·4
1911 - - - - -	44	22	50·0
1912 - - - - -	21	8	38·1
1913 - - - - -	24	12	50·0
1914 - - - - -	4	3	75·0
1915 - - - - -	12	6	50·0
1916 - - - - -	—	—	—
1917 - - - - -	1	—	—
Total in 18 years -	3,889	1,829	47·0

As in many of the South American republics, so in Brazil, the information respecting current epidemics is not always made public at the time; hence the statistical returns are to be regarded as provisional and as possibly understating the case.

A single fatal case of plague occurred at Rio de Janeiro in January 1918, but whether it was an imported instance or otherwise has not been stated.

Bahia.—The disease was prevalent in the port of Bahia (or, as it is sometimes called, San Salvador de Bahia), which had an estimated population in 1918 of 320,000. So far as can be ascertained, 114 cases and 82 deaths were recorded there in 1914, as compared with 188 attacks, 115 fatal, in 1913. The disease was most prevalent in the early months of the year and again in the last quarter. It is probable that the cases and deaths reported in 1914 are below the actual numbers which occurred. During 1915 there were 79 cases and 51 deaths from plague in Bahia; but particulars of these have not yet been published. In 1916 there were only 26 cases and 14 deaths in this port; and in 1917, up to September, there were 40 attacks, of which 29 were fatal. Plague has been present in Bahia since 1904, as may be seen in the following table :—

Plague in Bahia.

Year.	Cases.	Deaths.
1904	207	141
1905	4	2
1906	130	95
1907	115	94
1908	72	55
1909	116	70
1901	103	96
1911	5	3
1912	3	3
1913	188	115
1914	114	82
1915	79	51
1916	26	14
1917*	40	29
Total in 14 years	1,202	850

The case mortality-rate for the whole period was about 70·0 per cent. In this respect Bahia compares unfavourably with Rio de Janeiro, the case mortality in which for a series of years was only 47·0 per cent., against Bahia's 70·0 per cent. During the second half of 1916 plague appeared at Joazeiro, in the Province of Bahia, situated on the São Francisco River about 250 miles from the port of Bahia, with which it is connected by rail. Altogether from 1st June to 30th November 1916 67 cases were notified, with 51 deaths.

Pernambuco.—According to the Annual Report of the British Consul at Pernambuco, some 28 deaths from plague were certified in this port during 1914. The information from Pernambuco, which has a population of 230,000, is very meagre, and no details as to the number of attacks, nor the circumstances associated with them, have been forthcoming. In 1915 four fatal cases were reported and three in 1916. During 1917 seven cases and one death came under observation.

The deaths from plague in the city of Pernambuco from 1907 to 1917 are shown, year by year, in the following table :—

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* Nine months only.

Deaths from Plague in Pernambuco 1907 *to* 1917.

Year.	Plague Deaths.
1907	25
1908	19
1909	32
1910	21
1911	18
1912	20
1913	3
1914	28
1915	4
1916	3
1917	1
Total in 11 years	174

In the State of Pernambuco towards the end of 1916 plague was reported to be present at Garranhuns, an inland town situated 150 miles from Pernambuco city and connected with it by rail. This prevalence still continued during the early months of 1917. According to a report published in the *Buenos Aires Herald* of 21st March 1917, plague was then spreading, and the Government Health Department had been appealed to for help in controlling the malady. From January to September 1917, 49 cases and 41 deaths occurred in the State of Pernambuco, in the districts of Bom Conselho, Canhotinho, and Corrientes Garranhuns.

Port Alegre.—Sporadic cases of plague came under notice during 1915 in Port Alegre, the capital of the Province of Rio Grande do Sul, having a population of 40,000. Among those attacked was an English engineer, who died from the disease in May, having arrived in Port Alegre in February.

VENEZUELA.

The information as to plague in Venezuela is scanty, and the authorities of this Republic have been conspicuous in the past for pursuing the policy of concealment when outbreaks of epidemic diseases have occurred in the country. There is some evidence that plague appeared during 1914 at Caracas, the capital of the Republic, and also in the Province of Miranda. In the report of one of the medical officers of the United States Public Service it is stated that in 1914 at La Guaira, the port for Caracas and situated about 10 miles from it, rat-proofing of the Customs storage warehouses was being carried out, as also on the premises of some of the merchants at La Guaira. This suggests that plague had occurred at Caracas or elsewhere, and that rat-proofing of premises was being carried out to prevent the spread of plague. The disease has for some years been occurring regularly at Caracas, which has a population of 67,000, but no details as to the number of cases and deaths have been obtainable. Plague occurred at La Guaira in 1912, and though it may have been present in later years, no information has been given by the Venezuelan authorities; it cannot then be said definitely that the disease has not been occurring since 1912 in La Guaira. The sanitary condition of Caracas, as well as that of other towns in Venezuela, is unsatisfactory. The death-rate in Caracas in 1914 was 38 per 1,000, and the infantile mortality-rate was said to be very high.

There is no information as to plague in Venezuela in 1915, 1916, and 1917.

CUBA.

Plague had appeared in Cuba at Havana, the capital and chief seaport of the island, in July 1912, when three cases were observed; but after that no more was heard of the disease until February 1914—that is, 18 months later—when cases began to be reported in a block of buildings not far from the water-front, and adjacent to the block in which the 1912 cases had occurred. About a fortnight before the first case of plague was recognised in Havana in 1914, an unusual mortality among rats had been noticed, and in consequence anti-rat measures had been more actively put in force. After this, it was not until April that any plague-infected rats were found in Havana. From February to July some 29 human cases of plague came under observation in the city, which has a population of 300,000. All the earlier cases were Spaniards who were living amidst insanitary conditions. It is still a disputed point whether this second outbreak of plague in Havana was due to a recrudescence of the 1912 infection, or arose as a result of a fresh importation of the disease. Dr. Juan Guiteras, Director of Health for the Island of Cuba, believes that in 1912 plague was brought to Havana from the Canary Islands not by a human carrier nor by rats, but by infected fleas, which had been conveyed inside sugar sacks. During May 1914 an infected rat was found at a freight station, about 22 miles from Havana, on the railway between the capital and Matanzas. Vigorous measures were employed at the time, and no more infected rodents were found there. In June, plague cases began to be reported at the town of Santiago, with a population of 53,000, the former capital of Cuba, and situated on the coast at the eastern end of the island; here also infected rats were found about the same time. Altogether 14 persons were attacked at Santiago. Scattered cases occurred in a number of other places in Cuba, all owing their infection to the original focus in Havana, and among these were Artemesia, a town 35 miles distant; El Caney, near Santiago; and San Jose de las Lajas, which lies 12 miles south of Havana. In June a plague epizootic in rats was discovered at Jaruco, a town about

26 miles from Havana, having a population of over 12,000; but, so far as is known, no human cases occurred.

Of 48 plague cases which were admitted to have occurred in Cuba during 1914, only 11 died, giving a case mortality-rate of 23 per cent. Many of the cases, it appears, were treated by the intravenous administration of massive doses of Yersin's serum, and, according to Dr. Guiteras, this method of treatment seems to be the best that is known up to the present, and may account for the low plague case mortality-rate mentioned above.

The preventive measures applied in Cuba in 1914 were directed primarily against the rat and the flea. Since 1912 "deratisation" of premises has been carried out at Havana, and many houses have been made rat-proof. For rat destruction, hydrocyanic acid gas was used in warehouses, drains, &c., by means of special apparatus. Persons were threatened with fines who permitted rat-holes or rat-runs to exist on their premises. While the fumigation of certain blocks of houses was being done, 9,000 persons were displaced temporarily and sheltered alsewhere for 20 days before they were allowed to resume occupation of their houses. Dr. G. M. Guiteras believes that plague, like other epidemic diseases, may be controlled and eradicated with comparative ease if the health authorities are given the necessary legal and financial powers to enable them to carry out the proper measures. The human plague case he regards ordinarily as a negligible factor in a well-organised campaign, and that passenger traffic need not be interfered with while controlling the spread of plague.*

At the end of January 1915 the disease re-appeared, both in man and rats, in Havana, where, up to August, 18 more cases were reported. At Santiago, in February 1915, an infected rat was found. Plague cases also occurred in March at Guanabacoa, a small town across the harbour from Havana, and at Pinar del Rio, about 100 miles west of Havana.

Cuba appears to have remained free from plague during 1916 and 1917.

THE AZORES OR WESTERN ISLANDS.

The islands of the Azores, situated in the mid-Atlantic, are a Portuguese possession, its capital being Angra do Heroismo on the island of Terceira. The Azores are not regarded as a colony, but as a province of Portugal.

Plague has been appearing in this group of islands since 1910, more particularly on the islands of Terceira and Fayal. During 1911, 1912, and 1913 the presence of the disease had been reported, and in 1914 the Annual Report to the Foreign Office on the consular district of the Azores stated that in the island of Terceira "plague still continued to be recurrent."

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* Report on plague in Havana, by Dr. G. M. Guiteras, published in the *Journal of the American Medical Association* for 2nd January, 1915.

In 1915 the disease was again reported in Terceira and also in the summer of 1916.

None of the reports received give any details of these recurring outbreaks, nor is the number of cases or deaths mentioned in any of them. As has been said, the town of Angra is the capital of the Azores, and has a population of 10,000. It has been, so far as can be ascertained, the chief scene of the plague manifestations since 1910.

ALGERIA.

In May 1917 plague appeared in the neighbourhood of Constantine, which is the capital of Algeria, having a population of about 60,000. The first cases occurred at Hamma, about 10 kilometres from Constantine, with about 6,658 inhabitants, only 156 of whom are Europeans. The main business of this place is associated with flour mills and stores. The mills were known to be infested with rats. The first human case occurred on 5th May, and up to 13th May there were 12 attacks, of which 10 proved fatal. Four other cases were subsequently reported, of which two succumbed to the malady, making a total of 16 cases and 12 deaths, all natives. Of this total, 12 occurred at Hamma, one at Bizot, two at Aïn-M'lila, and one at Constantine. Eight of the cases are said to have resulted from direct human infection. It was reported that an outbreak of rat-plague had occurred about three months earlier at Philippeville, 50 miles from Constantine by rail. It is surmised that infected rats had been conveyed in sacks or bales from the port of Philippeville to Hamma. Bacteriological examination of rats found dead in the flour mills at the latter place showed that they had died of plague, and it was found upon inquiry that dead rats had been discovered prior to the human outbreak, though the cause of death had not been then recognised. In a flour mill recently taken over by the chief proprietor, but in which work had not been started at the time of the human outbreak, the caretaker had been rasing poultry, rabbits, and guinea-pigs. About a month before the outbreak many of the guinea-pigs (about half of the lot) had died off in a few days, but the nature of the epizootic had not been ascertained. There had been no mortality among the rabbits. The last infected rat was found at Hamma on 12th June. Dr. L. Raynaud,* who reported on this plague outbreak, draws attention to the predominance of the septicæmic form of the disease, and to the spread of the infection from case to case in at least eight of those attacked. A campaign against rats at Hamma was at once carried out, the sick persons were removed to the lazaret, house-to-house visits were made, most of the infected clothing and bedding was burnt, and some prophylactic inoculations were performed. So far as is known these measures were entirely successful and no recurrence of the disease took place.

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* *Revue d'Hygiène*, August, 1919.

MOROCCO.

Scattered cases of plague occurred during 1914 at a number of places situated along the west coast of Morocco. In January some attacks were reported at Casablanca (or Dar-al-Baida); in February and March at Fedala, Rabat, and Laraiche. Later in the year information was published in the press that plague had broken out at Knitra (or Kenitra) a port on the west coast of Morocco, with a population of 5,000; but no particulars were given as to the number of cases or deaths.

Plague had been present in 1913 at Casablanca, Rabat, and Laraiche, so that the 1914 cases were due in all probability to the old infection and not to an importation from without. The population of Morocco is estimated at about 6½ millions.

In August 1915 a number of cases of an illness characterised by fever and buboes were reported in Tetuan, the capital of Spanish Morocco, and its vicinity. The Spanish medical men who treated the patients said that the prevalent malady was "acute paludism." Most of the cases occurred at Isardy, a position occupied by Spanish troops 5 miles from the town of Tetuan, and sometimes known as Taher-el-Soor. Up to 26th August, 16 cases and four deaths had been recorded, among them two Spanish soldiers and two of the native troops. The British Consul in September reported that the Spanish authorities admitted that the illness was plague of a mild type. In October the malady was still manifesting itself, the last fatal case occurring on 13th October. In September plague appeared at the port of Arzilla on the Atlantic coast of Morocco, 40 kilometres south of Tangier, and again in October. The number of cases was not stated. In October 1916 plague broke out at Rabat and continued during the rest of the year. On January 3rd, 1917, the disease was stated to have disappeared, the last cases having been reported on 26th December 1916.

There is no report as to the occurrence of plague in Morocco during 1917.

TRIPOLITANIA.

About the end of 1913 a disease believed to be plague, appeared at Benghasi, in the Province of Cirenaica, exclusively among the poorest natives and especially among the Soudanese blacks. Most of the cases occurred outside the town, in the adjoining villages. The Benghasi officials denied that the current malady was true plague, but, so far as can be ascertained, the evidence seems to uphold that diagnosis. The British Consul states that only three or four Europeans were attacked by the disease; in the absence of published statistics, however, he is not able to give the actual number of cases and deaths. At the end of the year the malady seemed to be quiescent, notwithstanding the apathy and prejudice of the natives. Bengasi (or Benghazi) is a place of some importance, with a population of about 35,000. It is not only a port, but it forms the starting-point for caravans setting out overland for Egypt, the route being direct to Cairo across the desert.

A case of plague was reported at Tripoli in December on board the s.s. "Misurata," while lying in the harbour, having arrived five days previously from a number of local ports along the coast, including Bengasi and Derna. Infected rats were found on the vessel. About the same time plague appeared among the native labourers working at Derna and at Marsa Susa. Derna is a port in the Province of Cirenaica, on the north-east coast of Tripolitania. Other cases of plague were reported in June 1914 at Shemines and in July at Azizia, Tarhuna, and Lanzur, but no details were given.

Plague had been present during 1913 in Tripolitania at Derna and at Tripoli, cases having also occurred among the troops of the Italian Army of occupation of that country.

The population of Tripolitania is estimated at about 1,300,000.

During October 1916 plague was reported by the British Consul to have appeared in Tripoli among the Italian troops, and especially at a fort at Fornaci, a few miles outside the town. The Consul stated that, up to 27th October, 14 cases, with only four deaths, had occurred.

In April 1917 plague appeared at Benghasi and in its environs. It was said that cases had also occurred among the native-Italian troops between Derna and Benghasi. In all, 278 cases were reported in Cyrenaica during 1917, and of these, 135, or 48·5 per cent., died. Dr. Mazzoni states that active immunisation by Haffkine's method was tried, but was not found to guarantee protection against attack; on the other hand, it was found to reduce materially the severity of the illness. The outbreak was attributed to imported infection; no mortality was observed among rats.

In June 1918 the Government of Malta again declared Benghasi an infected place, as information had been received stating that plague still existed at the place.

FRENCH WEST AFRICA.

Plague appeared at Dakar, the capital of French West Africa, in April 1914; the epidemic that followed affected the population in the vicinity of the town, continuing up to January 1915. Cases also occurred in other parts of Senegal, and the infection was carried to the neighbouring Cape de Verde Islands. It was believed by some persons that plague was introduced into the port of Dakar from the Brazilian port of Bahia; others regarded

Casablanca in Morocco as the place from which the infection had been derived. The s.s. "Mingreli," which arrived at Dakar on 6th April, is now generally regarded as having conveyed the infection from the Moroccan port of Casablanca. The population of Dakar is about 20,000, and 1,425 deaths among them were recorded from plague in the period from April 1914 to January 1915. It is also asserted that there was concealment of cases, so that fatal instances of plague were reported under some other headings. The first cases are said to have occurred in that part of Dakar in which the Moroccans lived. Among the European population of Dakar, only seven cases and three deaths were recorded. It is estimated that, in the colony, about 8,686 persons died in 1914 from plague.* The earlier attacks were of the pneumonic type, and it is said that at that time there was no observable infection of the local rats, and it was asserted that the infection, at first, was spread by human agency alone. By the time the epidemic had developed, however, many animals, including cats, monkeys (in captivity), rabbits and fowls, as well as deer, died of some prevalent malady thought to be plague. But only in two cats, a monkey, and a civet cat was the disease demonstrated to be plague by bacteriological examination. It was not till July that rats were discovered to be infected. The British Consul-General at Dakar reported that in October plague had spread to the villages of Kahore and Lyndiane in the district of Sine Saloum, and that the villages of Kaslack, Bourudon Sohare and Sine Lyndiane were believed also to have been infected. In the village of Yoff, 16 kilometres from Dakar, with 2,000 inhabitants, no fewer than 1,200 died of plague in 1914.† The presence of plague was reported in April 1914 at St. Louis, a town on an island at the mouth of the Senegal River about 100 miles from Dakar. The flight of panic-stricken persons from the latter town into the adjoining districts served to spread the disease.

Haffkine's prophylactic inoculation was performed on many persons at Dakar, and the total number of inoculations throughout the colony amounted to 13,596.

In July 1915 the occurrence of 13 plague cases was reported at Tiarroye, not far from Dakar and situated on the railway line from that town to St. Louis.

Nothing seems to have been heard of plague in Senegal during 1916; but, in May 1917, the disease was reported at St. Louis and in several districts near it. Ultimately the "cercles" of Cayon, Dagana, Louga and Tivouanne became infected. In the last-named place over 200 deaths resulted, but the number of attacks has not been given. In the village of Thilla, near St. Louis, 45 deaths occurred from plague in the second half of 1917. No information as yet has come to hand regarding the number of persons attacked in Senegal by plague during the year.

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* Epidémie de peste qui a sévi à Dakar et au Sénégal d'avril, 1914, à février, 1915. Dr. Kermorgant in the *Bull. de l'Académie de Méd.*, No. 33, 1916.

† Dr. A. Lafont, in the *Bull. de la Société de Pathologie Exotique*, Vol. viii., No. 9.

In June 1918 information reached this country that a serious plague epidemic had developed early in the year in Senegal, involving chiefly the town of St. Louis, and the districts of Tivouanne, Thies, Louga, Baol and Rufisque; the total cases reported from 8th January to 25th July 1918 being 1,526, with 1,229 deaths, giving a fatality-rate of 80·4 per cent. A later report distributes the figures as follows :—

		Cases.	Deaths.
In St. Louis	- - -	584	508
In the Cercle de	Baol -	47	30
,, ,,	Dagana -	5	4
,, ,,	Louga -	10	9
,, ,,	Rufisque -	14	8
,, ,,	Thies -	178	139
,, ,,	Tivouanne	688	531
	Total - -	1,526	1,229

This last outbreak coincided with the time when the recruiting of black troops was at its maximum.

GOLD COAST.

In the Northern Territories of the Gold Coast, according to the Annual Report of the Chief Commissioner for 1914, a disease, said to resemble plague very strongly, broke out at a small village near Yeji in 1913, and reappeared during 1914 at the fishing village of Makongo, which is also situated near Yeji. A medical officer was sent to investigate the outbreak and report upon it. He was only able to see four cases, one of which was fatal; but he heard of five other instances, of which four had a fatal termination before his arrival. It is presumed that the diagnosis of plague was confirmed. Nothing, however, has transpired to explain the origin of the outbreak in a district where, so far as is known, no previous cases of plague had occurred.

Though no actual notification of plague occurred in this colony during 1915 and 1916, there was some suspicion that, possibly, plague had been present unrecognised. The death returns for Accra, the capital of the Gold Coast, in 1915 showed that, out of a total 843 deaths, 118, or 14 per cent., were attributed to pneumonia and cough; in 1916 the deaths numbered 1,131, of which 139 were ascribed to pneumonia and cough. Unfortunately, the death returns cannot be relied upon, as illnesses of infectious kinds are often concealed from the authorities by the natives.

A mysterious and fatal disease broke out at the end of January 1917 in Ofako, which lies about 9 miles inland from Accra, and from Ofako it spread to six other places, including Accra. The malady was said to have been definitely recognised as plague, but the source whence it came has not been traced. There were six deaths officially reported, but it is stated that at least 39 persons lost their lives from plague in this outbreak at Accra. It is officially stated that there were but few rats at Ofako, and it was thought, therefore, that the disease had not originated among the local rodents.

During December 1917 several deaths were certified from plague in the port of Axim, which is situated in the Gold Coast Colony, about 150 miles west of Accra. The outbreak, according to subsequent reports, comprised nine cases, seven of which were fatal; the type of the disease was alleged to have been the pneumonic. In July 1918 another outbreak of a malady suspected to be pneumonic plague occurred at Axim, but details of this had not been received at the time of writing.

THE UNION OF SOUTH AFRICA.

In July 1914 the occurrence of a mysteriously fatal lung disease, afterwards recognised as pneumonic plague, came under the notice of the officials of the Cape Province, and an inquiry by Dr. P. Targett Adams, Assistant Medical Officer of Health for the Union of South Africa, showed that some of the early cases had been discovered in a native kraal in the Kamustone area, and among the Kaffir labourers employed upon the scattered farms of the sparsely populated districts of Queenstown, Tarka, Middelburg and Maraisburg. From July to October some 35 cases came under official observation, and 31 of them died, giving a case mortality-rate of 88·6 per cent. The attacks were nearly all of the pneumonic type, and all who suffered were natives, with the exception of two Europeans. No definite evidence that rats or mice had been infected could be found, and Dr. Adams formed the opinion that they had played no direct part in the spread of the infection. He believed that the disease had been spread by natives of insanitary habits, travelling from place to place, stopping at nights in overcrowded native huts which were greatly lacking in light and ventilation and which were swarming with vermin. These conditions seemed to him likely to assist the spread of pneumonic plague. Dr. Adams, it may be mentioned, is of opinion that body lice are capable of transmitting the virus of bubonic plague. It is possible that the recorded number of cases and deaths might have been increased if opportunities for careful inquiry had been available earlier. Some of the fatal cases were only discovered after death had taken place. It may be added that, as evidence of rats and mice being infected were not obtained, search was made for traces of the disease among other animals, including thr South African mongoose (*Crissarchus fasciatus*) and the meerkat (*Suricata tetradactyla*), which abound in the neighbourhood and which are handled by the natives, but only negative results were obtained.

No further cases were observed after October 1914 until December, when another localised outbreak occurred in the Cape Province in the same locality (including the additional districts of Cradock and Wodehouse) as that in which the previous cases had been observed. From December 1914 to June 1915, some 45 attacks and 26 deaths were reported; 12 of the cases were only discovered after death had taken place. In the second outbreak the type is said to have been bubonic, and therefore less virulent than the first; the case mortality rate in the second outbreak was only 57·7 per cent., as compared with 88·6 in the first. Eight Europeans were among the 45 persons attacked in 1915, and five of them died. The distribution of the cases and deaths among the invaded districts was as follows:—

	Cases.	Deaths.
Queenstown District -	19	12
Tarka ,, -	13	7
Molteno ,, -	1	1
Maraisburg ,, -	3	3
Cradock ,, -	7	1
Wodehouse ,, -	2	2
Total - -	45	26

Thus, from July 1914 to June 1915, 80 cases of plague, with 57 deaths, occurred in the Cape Province, the fatality rate being 71·2 per cent. The precise origin of these two outbreaks has not been definitely determined. The last recorded appearance of plague in South Africa, prior to this, was in 1912, when 33 cases and 26 deaths occurred in Natal, at Durban and its vicinity.

In the *Bulletin* of the *Office International d'Hygiène Publique* for December 1915, it is stated that 60 cases of plague occurred at Port Elizabeth during the period 8th February to 17th April, 1915; but no further information concerning this alleged outbreak of plague has come to hand.

No more was heard of plague in the Union of South Africa during the rest of 1915; but in January 1916 a fresh appearance of the disease occurred in the Orange Free State, involving mainly the districts of Hoopstadt and Winburg; later the Senekal district became affected. Up to 1st April, 36 persons were attacked; of whom 7 were Europeans and 29 coloured; there were 23 deaths, including 3 Europeans and 20 coloured persons; the case mortality rate was 64 per cent. Nine of the cases did not come under observation till after death had taken place. Among the deaths caused by this outbreak was that of Dr. P. A. Gillespie, District Medical Officer of Winburg, who had been attending some of the plague cases. No plague infection of the local rats was discovered, although sought for; the source of this outbreak remains untraced.

In September 1916 a fresh outbreak of plague occurred in the Cape Province, chiefly at Balmoral in the Uitenhage district, about 25 miles north-west of Port Elizabeth. From 23rd October to 12th November, 54 cases had been reported, with 24 deaths, all coloured persons. Five of the cases were discovered after death had taken place. Another outbreak developed in December 1916 and extended into January 1917, in the Potchefstroom district of the Transvaal Province. Altogether, 12 cases were definitely diagnosed as plague and all proved fatal. The victims were natives employed on local farms.

In February 1917 another group of plague cases was discovered in the Winburg district of the Orange Free State and, up to 15th April, 26 cases and 17 deaths had been recorded mostly, among native workers on farms in Winburg and Hoofstadt districts. On 28th May, that is after an interval of six weeks, a native was found dead on a farm in the Winburg district, and another native, who had been in contact with him, died of plague while under observation. During May a native agricultural labourer was found dead on a farm in the Tarka district, Cape Colony, and his death was attributed to plague. Nothing further was observed until 12th August, when a native died of plague at Boltwa, in the Glen Grey district in the Cape Province. So far as can be ascertained, no connection was traced between these scattered cases of plague occurring among the native workers on the various isolated farms.

NORTHERN RHODESIA.

In May 1917 the High Commissioner of South Africa reported that the Administrator of Northern Rhodesia had announced an outbreak of disease, suspected to be plague, among natives on the Luangwa River, which flows into the Zambesi, 93 natives having died from the prevalent malady out of 96 persons attacked. Dr. Kinghorn had been despatched to the locality to investigate and report, but said that he was too late to see any cases on which to base a definite diagnosis. From the symptoms described to him, however, he was led to the opinion that the outbreak was one of true plague.

In December 1917 the Administrator of Northern Rhodesia reported a further outbreak of disease in the Luangwa Valley; and this continued up to May 1918. The total attacks in this second outbreak amounted to 59, of which 57 proved fatal. Concurrently with the human epidemic there was an epizootic among the local rats, attended with an unusual mortality. As before, doubts were locally expressed as to the true nature of this epidemic, the officials concerned being naturally reluctant to admit the presence in their midst of so formidable a malady as plague. But after considering all the facts, and especially the existence of a concomitant epizootic with high mortality among the rats of the affected district, as also the extreme fatality of the human malady, so far unexplained, and no alternative diagnosis suggested: and furthermore the circumstance that at precisely the same season in the previous year a similar outbreak occurred, there seems little ground for doubting that this was a genuine appearance of true plague. Although the natives had been warned to evacuate their houses as soon as any dead rats were discovered, this warning was neglected, and the existence of dead rats was concealed. In order to cut the outbreak short the native huts were burnt and other shelter provided. It is very probable that there were more cases and deaths resulting from the malady than were reported to the authorities. The outbreak affected six villages in which the commonest species of rat infesting the houses was *M. rattus*, and all those affected by the epizootic were of this kind. The measures for controlling the spread of plague comprised the following:—

(1) Limitation of native movements as far as possible;
(2) Burning of infected villages;
(3) An active anti-rat campaign.

One mode by which the infection was spread was traced, it is stated, to the local custom of polygamy. Commonly, a man has wives living in different villages, which he visits in turn from time to time. It is suggested that the husband carried infected fleas from one place to another. It is worth mentioning that of the 59 persons attacked in the second outbreak in the Luangwa Valley, 33 were females and 26 males. Orders had been given after the first epidemic to burn the infected villages, and this was done; but the stores in which the grain is kept for the villagers' consumption are generally built outside the villages and for this reason these stores escaped the burning. But as these are the favourite haunts of the local rats, the infection of plague was kept alive by them from one season to the next.

ISLAND OF RÉUNION.

Through the usual diplomatic channels a dispatch was sent to this country from the Norwegian Government in March 1917, to the effect that the Island of Réunion was now considered free from plague by the Norwegian authorities. This notice seems to suggest that plague had been recently occurring in Réunion, although no information on the subject had been sent to the Local Government Board.

It may be remembered that in 1899 suspicion arose that plague had been occurring in Réunion under the disguise of "lymphangite infectieuse," a malady that had long been prevalent in the island. Dr. Thiroux, of the Pasteur Institute, Paris, was employed to investigate the nature of this illness, and pronounced it, as a result of careful inquiries, to be true plague. It is therefore possible that the so-called "lymphangite infectieuse" is still occurring in Réunion, and that the Norwegian Government has become aware of the fact, which, however, had not come to the knowledge of the other Powers.

MAURITIUS.

The monthly official reports received from Mauritius, dating from 10th January 1914 to 9th January 1915, give the number of plague attacks in this colony as 128, and the deaths 111. Of the nine districts into which the island is divided for administrative purposes, plague appeared in four of them, namely, in Port Louis, 76 cases (and 71 deaths); Black River, 30 (20); Plaines Wilhems, 21 (20); and Rivière du Rempart, a single case. As regards the racial distribution: two fatal cases occurred among white Mauritians; 34 attacks (and 30 deaths) among non-white Mauritians; 85 (73) among Indians; and 7 (6) among Chinese. Of the 128 cases, 56, or 43·7 per cent., were discovered after death had taken place.

During the year 125,597 rats were destroyed, and of these 28,191 were examined, with the result that 1,867, or 6·6 per cent., were found infected.

The following table gives the number of human cases and deaths reported in each month during 1914, the number of rodents destroyed, the number examined, and the number and percentage of those found infected* :—

1914.	Human Plague.		Rodents destroyed.	Rodents examined.	Rodents found infected.	Percentage of Rodents infected to those examined.
	Cases.	Deaths.				
January - -	21	14	8,328	1,697	146	8·6
February - -	19	15	9,048	1,641	252	15·4
March - - -	2	2	10,398	1,775	182	10·3
April - - -	2	2	11,147	2,041	80	3·9
May - - -	—	—	12.753	2,582	92	3·6
June - - -	—	—	12,691	2,169	107	4·9
July - - -	—	—	11.000	2,818	113	4·0
August - -	—	—	10.720	2,651	99	3·7
September - -	11	10	10,310	2,605	133	5·1
October - -	14	13	10,853	3,518	234	6·6
November - -	23	22	9.287	2,521	188	7·5
December - -	36	33	9,062	2,173	241	11·1
Total -	128	111	125,597	28,191	1,867	6·6

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* The rodents include rats mice, and musk rats.

The year 1914 showed the largest number of infected rats discovered amongst those examined, though 1913 yielded the highest percentage of infected animals.

The incidence of plague in the island of Mauritius showed a considerable decrease in 1915, the weekly returns giving an aggregate of only 33 cases and 22 deaths, the lowest numbers recorded since plague invaded the colony in 1899. Three of the cases were not discovered until death had taken place. As regards 26 of the cases of which particulars are available, 22 were referred to the district of Savanne, two to Port Louis, and two to Plaines Wilhems. Twenty-one of those attacked were Indians, four were Chinese, and one a "non-white Mauritian." The following table gives for 1915, month by month, the number of human cases and deaths, the number of rodents destroyed, the number examined, and the number found infected by plague, together with the percentage of animals infected to those examined:—

1915.	Human Plague.		Rodents destroyed	Rodents examined.	Rodents found infected.	Percentage of Animals infected to those examined.
	Cases.	Deaths.				
January - -	10	9	8,240	1,705	146	8·6
February - -	—	—	7,729	1,818	133	7·3
March - - -	—	—	8,582	2,015	39	1·9
April - - -	1	1	7,791	1,941	20	1·0
May - - -	—	—	8.775	2,233	17	0·7
June - - -	1	1	10.579	2.655	17	0·6
July - - -	—	—	10.179	2,538	19	0·7
August - -	4	2	9,632	2,366	15	0·6
September - -	9	6	9.948	2,902	18	0·6
October - -	7	2	9,820	2,790	21	0·8
November - -	1	1	8.657	2,646	20	0·8
December - -	—	—	7,916	2,329	13	0·6
Total -	33	22	107,848	27,938	478	1·7

For the 12 months, 10th January 1916 to 9th January 1917, 22 cases and 15 deaths from plague were reported in Mauritius. 16 of the cases with 10 deaths being recorded in the period 10th December 1916 to 9th January 1917. Of these 22 cases, nine were non-white Mauritians, 11 were Indians, and two Chinese. Five of the cases were discovered after death had occurred. During 1916 the number of rodents destroyed was 122,389; of these, 44,790 were examined and 204, or 0·5 per cent., were found infected by plague. The next table gives the particulars as to human cases, rodents destroyed, examined, and found infected.

1916.	Human Plague.*		Rodents destroyed	Rodents examined	Rodents found infected.	Percentage of Rodents infected to those examined.
	Cases.	Deaths.				
January - -	1	1	8,569	2,021	26	1·3
February - -	2	2	8,610	1,995	30	1·5
March - -	—	—	10,171	2,946	27	0·9
April - - -	1	1	9,498	2,960	22	0·7
May - - -	—	—	9.213	3,745	27	0·7
June - - -	1	1	11,005	4,005	17	0·4
July - - -	—	—	10,040	4,348	18	0·4
August - -	—	—	10,421	4,551	13	0·3
September - -	—	—	12,120	5,088	8	0·2
October - -	—	—	11,071	4,020	6	0·1
November - -	1	—	10,072	4,202	4	0·1
December - -	16	10	11,599	4,909	6	0·1
Total -	22	15	122,389	44.790	204	0·5

During 1917 human plague may be said to have disappeared from Mauritius, for, except eight cases which were reported in the first month with seven deaths, no attacks or deaths were recorded during the rest of the year. Some infected rats, however, continued to be discovered throughout the year, as will be seen in the next table, which gives the total number of rodents destroyed in the 12 months ended 9th January 1918, the number examined, the number found infected, and the percentage of infected rodents to the number examined :—

	Human Plague.		Rodents destroyed.	Rodents examined.	Rodents found infected.	Percentage of Rodents infected to those examined.
	Cases.	Deaths.				
January - -	8	7	10,470	4,157	16	0·38
February - -	—	—	11.169	3,451	13	0·38
March - -	—	—	11,398	3,942	10	0·25
April - - -	—	—	10.020	3,563	5	0·14
May - - -	—	—	13,304	4,516	4	0·09
June - - -	—	—	15,417	5,869	3	0·05
July - - -	—	—	13.413	5,102	4	0·08
August - -	—	—	13,562	3,160	—	—
September - -	—	—	11,028	3,118	6	0·19
October - -	—	—	10,765	3,762	5	0·13
November - -	—	—	11,753	4,630	5	0·11
December - -	—	—	12,412	3,954	1	0·03
Total -	8	7	144,711	49,224	72	0·15

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* Human cases for the year ended 9th January, 1917; rodents for the calendar year, 1916.

Three of the human fatal cases of plague in 1917 were found after death had taken place.

Of 10,478 rats examined during the first three months of 1918 only two were found infected, and during the same period no human cases were reported.

Port Louis is the capital and principal port of Mauritius; it has a population of about 50,000. Plague has been present in the town continuously since 1899, and more than 65 per cent. of the total plague mortality in the island has been referred to Port Louis. The chief plague season is from August to January. The deaths recorded from plague in Port Louis from 1899 to 1918 were as follows :—

Year.	Plague Deaths.
1899	711
1900	302
1901	591
1902	262
1903	753
1904	266
1905	206
1906	311
1907	105
1908	110
1909	182
1910	301
1911	48
1912	372
1913	157
1914	63
1915	7
1916	—
1917	—
1918	—
Total in 20 years	4,747

The last case of plague reported in Mauritius occurred on 27th January 1917. In a report to the Colonial Office, the Governor of Mauritius estimates the cost incurred in connection with the plague prevalence since 1900 at 2,967,538 rupees.

For the purposes of comparison of one year with another the following table has been compiled, showing from 1899 the number of human plague cases and deaths recorded in Mauritius; and from 1906, when the figures were available, the number of rodents destroyed in each year, the number examined for evidence of plague, and the number found infected, and giving also the percentage of infected animals to the number examined.

*Human and Rodent Plague in Mauritius,** 1899 *to* 1917.

Year.	Human Plague.		Case Mortality-rate.	Rodents destroyed.	Rodents examined.	Rodents found infected.	Percentage of Rodents infected to those examined
	Cases.	Deaths.					
1899 -	1.416	1,117	78·9				
1900 -	996	593	74·5				
1901 -	1,093	805	73·6				
1902 -	506	384	75·7	Figures not available till 1906.			
1903 -	1,395	1,035	74·2				
1904 -	568	449	79·0				
1905 -	308	251	81·5				
1906 -	428	344	80·1	103,643	9,263	170	1·8
1907 -	229	178	77·7	125,552	12,365	139	1·1
1908 -	170	137	77·0	172,504	10,719	230	2·1
1909 -	455	333	73·2	141,733	14,769	452	3·1
1910	562	553	98·4	115.912	24,556	182	0·7
1911 -	173	131	75·7	96.540	21,485	142	0·7
1912 -	659	541	82·1	90,834	13,914	605	4·3
1913 -	313	261	83·4	97,686	15,120	982	6·5
1914 -	128	111	88·8	125,597	28,191	1,867	6·6
1915 -	33	22	66·6	107,848	27,938	478	1·7
1916 -	22	15	68·4	122,389	44.790	204	0·5
1917 -	8	7	87·5	144,711	49,224	72	0·1
Totals	9,462	7,267	76·8	1,444,949	272,334	5.523	2·0

The population of the island of Mauritius in 1911 was 368,791.

ZANZIBAR.

On 31st December 1913 a case of plague was reported in Zanzibar, the patient having arrived on the previous day from Dar-es-Salam in German East Africa, on board the s.s. "Präsident," and died on 2nd January 1914, during which month five cases and four deaths were reported; in the same period 3,000 rats were examined, 13 of them being found infected. Although infected rats were found in Zanzibar in February, March, April and May, no human cases were reported in any of those months. But in June, July, August, September, October, and November scattered cases came under notice, making up the total attacks in 1914 to 39, of which 26, or 66·6 per cent., had a fatal termination. The number of rats collected in the town during the year was 48,207, and of them 215 were found, upon examination, to be infected. In the previous year there had been no human plague cases in Zanzibar, excepting the imported instance mentioned above, and which arrived on shipboard from German East Africa; but 51,000 rats were collected in 1913 and destroyed, 14 of which were found to be plague-infected. The population of Zanzibar is stated to be 198,914.

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* Report by Dr. F. L. Keisler, Acting Chief Sanitary Officer, Colony of Mauritius, dated 6th October, 1918.

Only a single case of plague, which proved fatal in March, was recorded in Zanzibar during 1915, and although nearly 42,000 rats were examined, not a single one was found to be infected.

In 1916 and 1917 no human plague was reported; but in 1916, of 47,049 rats collected from various parts of the town of Zanzibar, four were found to be infected by plague. During 1917, 13.647 rats were examined microscopically, but none were discovered to be infected.

"GERMAN EAST AFRICA."

From March to 24th July 1914 there occurred 26 cases and 21 deaths from plague in Dar-es-Salam, the chief seaport of German East Africa, situated about 45 miles from Zanzibar. Infected rats had been discovered during April. No information as to the incidence of plague in Dar-es-Salam during the second half of the year has come to hand.

In Muanza, on the southern shore of the Lake Victoria Nyanza, seven cases of plague, six of them fatal, came under observation during February and March 1914; three of those attacked belonged to the native police, three were Indians, and one was a native employed in destroying rats. In the previous year plague was epidemic in the Muanza district, 244 cases and 233 deaths having been recorded. Details are lacking as to the occurrences of plague in German East Africa since the commencement of the war, so that there is no information for 1915, 1916, and 1917. The population of "German East Africa" was stated to be about eight millions.

BRITISH EAST AFRICA PROTECTORATE.

Compared with 1913 the Protectorate suffered but lightly from plague in 1914. The disease appeared in sporadic form at Mombasa, Nairobi, Kisumu, Machakos, Makindu, and Maragoli. Only two cases, both fatal, occurred at Mombasa, where in the previous year 208 persons had been attacked; nine cases were reported at Nairobi, of whom six died; at Kisumu, 41 cases, 38 fatal, were treated, of which one case was a European lady, who recovered. At Maragoli during June and July 1914, 20 deaths from plague were recorded, but the number of cases has not been given.* The estimated population of this Protectorate at the present time is about four millions.

During 1915 in the coastal zone of the Protectorate plague was reported, but no infected rats were found. Cases were said to have been numerous in the Nyanza Province, but precise figures have not been given: 33 natives suffering from plague (29 of whom died) were admitted during 1915 to the isolation hospital at Kisumu. Cases also occurred in Nairobi, and North Kavirondo, near the Uganda border.

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* Annual Report of the East Africa Protectorate for the fiscal Year 1914-15.

In 1916 an outbreak of plague was reported on 8th October at Nairobi, and up to 11th November, 63 cases had been notified, 45, or 71·4 per cent. of which were fatal.

During 1917 the Officiating Administrator of the British East African Protectorate reported an outbreak of plague which occurred during April and May at Mombasa, but details have not so far been published, except that between 1st October and 31st December 31 cases and 18 deaths were recorded from plague.

NYASALAND.

Bubonic plague appeared for the first time in Nyasaland at the end of 1916, and there is little doubt but that it was introduced from German East Africa, there being at the time a considerable movement of native carriers between Karonga and Mwaya. Thirteen cases were reported at Karonga during November and December, and some persons were attacked during the early months of 1917, but the precise number has not yet been stated. A campaign of rat extermination was at once started, and prophylactic inoculation was offered to all willing to accept it. At the end of March 1917 the disease seemed to be under control, and there were no signs of any extension of the infection to other places in Nyasaland. The native population is estimated at 1,137,266.

UGANDA PROTECTORATE.

Plague is known to be endemic in certain parts of the Uganda Protectorate, mainly in the Eastern Province, though cases are found in the Buganda Province and in the districts west of the River Nile. The disease during 1914 spread in the Lango district of the Eastern Province, but where the necessary measures were applied for its prevention it could be kept under control. Native sanitary inspectors have been appointed to deal with plague and to prevent, as far as is practicable, the concealment of cases; the results of this policy appear to be satisfactory. Rewards offered for the destruction of rats in the affected localities produced in one district "surprising results."*

In the Annual Medical and Sanitary Report for 1914 it is stated that the deaths from plague in that year in Uganda numbered 3,725, as compared with 3,292 in 1913. To protect the people, prophylactic inoculation was offered and was accepted by 21,665 persons, but some of the native tribes still object strongly to the operation. A reward was offered for rats destroyed, and 565,271 were paid for during the year.

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* Annual Report of the Governor of the Uganda Protectorate for the fiscal Year 1914–15.

In 1915 plague was mainly prevalent in the Eastern Province. The deaths in three of the most infected districts amounted to 3,478, of which 1,912 occurred in the Bukedi district, 615 in Zeso, and 951 in Lango; the total deaths from plague in these three districts in 1914 had been 3,238. The offer of reward for destruction of rats in the Lango district was again attended with good results, and inoculation was carried out among the general population of that district. In the other districts comparatively few persons were inoculated. The prevention of concealment of cases was greatly assisted by the work of the native inspectors appointed for controlling the spread of plague (and other diseases).*

During 1916, according to native returns, and by reports of native inspectors in the Eastern Province, there were altogether 4,384 deaths from plague in the Uganda Protectorate. Outbreaks occurred at Kampala, Jingu, and Port Bell. At Kampala, and its environs, which is situated on Lake Victoria Nyanza, 273 persons were attacked, of whom 193 died; at Jingu there were 63 cases and 54 deaths, some being of the pneumonic form; and at Port Bell, 25 cases and 23 deaths were reported. In the Annual Report of the Protectorate for 1916 it is stated that the infection was probably conveyed to these three places through the instrumentality of rats, brought in cargoes of seed-cotton from the Eastern Province, where plague is endemic. The majority of the cases at Kampala are said to have been of the septicæmic type, showing no buboes, the diagnosis being confirmed by laboratory examinations. A native who assisted at one of the post-mortems was infected and died of plague.

EGYPT.

During 1914 there were 219 cases (and 111 deaths) of plague in Egypt compared with 654 (304) in 1913 and 884 (441) in 1912. This decrease in the amount of the disease was practically continued during 1915, when 235 cases and 120 deaths were recorded. In 1916 there was a considerable rise in the amount of plague reported in Egypt, the cases numbering 1,702 and the deaths 828. The year 1917 was more favourable, 732 attacks, of which 399 were fatal, coming under notice. From April to June cases of plague were detected among the British troops stationed along the Canal. During these four years the large proportion of the cases occurred in Upper Egypt, as in previous years. The following table gives the distribution of the plague cases and deaths among the different Governates and Provinces :—

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* Colonial Annual Reports: Uganda Report for fiscal Year 1915–16.

Plague in Egypt during 1914–15–16 *and* 17.

Governates or Provinces.	Population in 1911.	1914.		1915.		1916.		1917.	
		Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.
Cairo - -	*700,000	—	—	—	—	2		2	—
Alexandria -	394,578	43	23	10	5	61	35	17	9
Port Said -	55,366	50	20	19	11	32	19	40	25
Ismailia - -	12,018	1	1	—	—		—	2	—
Suez - -	21,000		—	—	—	1	—	318	195
Damietta -	11,060	1	—	—	—	—	—	—	—
Province of Assiout.	932,840	13	6	59	31	296	144	36	23
Assouan - -	235,000	—	—	—	—	2	—	—	—
Minieh - -	675,275	40	20	40	17	285	127	51	20
Gharbieh -	1,540,431	13	4	8	4	3	2	—	—
Fayoum - -	410,399	20	8	81	40	726	340	148	77
Dakalieh -	927,676	1	—		—		—	—	—
Monoufieh -	1,001,065	3	—		—	21	14		—
Guizeh - -	453,848	10	5	10	10	32	14	1	—
Keneh - -	786,789	23	23			5	4	54	36
Charkieh -	846,553	1	1	—	—	—	—	—	—
Galoubieh -	430,056	—	—	1		4	—	6	—
Benisouef -	365,880		—	7	2	182	89	2	—
Girga - -	874,000	—	—	—		50	40	55	14
Total -	—	219	111	235	120	1,702	828	732	399

* Population estimated.

The seasonal incidence of plague in Egypt during these four years is shown in the subjoined table :—

Months.	1914.		1915.		1916.		1917.	
	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.
January -	10	5	8	7	31	17	6	2
February -	5	3	8	7	53	33	10	6
March -	3	—	2	1	337	151	48	31
April -	14	7	44	21	601	305	124	57
May - -	67	44	57	20	436	209	125	61
June -	35	17	55	27	180	79	267	163
July -	38	16	16	8	46	28	106	63
August -	19	9	6	4	6	1	32	6
September	15	4	4	4	4	1	6	6
October -	7	4	1	—	1	—	4	3
November-	5	1	5	4	4	1	—	—
December-	1	1	29	17	3	3	4	1
Total -	219	111	235	120	1,702	828	732	399

Cairo.—Attention has been called in previous reports to the practical escape of Cairo from the incidence of plague. From 1906, when a single fatal case occurred, up to 1911, when two imported instances were reported, and in 1912, five cases. From 1912 to 1915 Cairo had no plague: in 1916 two cases came under notice, and two in 1917. The city has thus had only 12 cases in 12 years. This freedom from plague in a city with a population of nearly 700,000 is noteworthy in view of the fact that the disease has been prevalent in the rest of Egypt since 1899.

Alexandria.—Ever since 1899 Alexandria has suffered more or less from plague, as will be seen in the next table :—

Plague in Alexandria.

Year.	Cases.	Deaths.	Case Mortality
			Per cent.
1899 - - - - -	93	45	48·4
1900 - - - - -	36	25	69·4
1901 - - - - -	52	26	50·0
1902 - - - - -	101	51	50·5
1903 - - - - -	129	83	64·3
1904 - - - - -	108	70	64·8
1905 - - - - -	127	87	68·5
1906 - - - - -	99	61	61·6
1907 - - - - -	152	89	58·6
1908 - - - - -	100	57	57·0
1909 - - - - -	23	17	73·9
1910 - - - - -	45	27	60·0
1911 - - - - -	52	21	40·4
1912 - - - - -	33	15	45·4
1913 - - - - -	95	57	60·0
1914 - - - - -	43	23	53·5
1915 - - - - -	10	5	50·0
1916 - - - - -	61	35	57·4
1917 - - - - -	17	9	52·9
Total in 19 years -	1,376	803	58·3

The course of the plague prevalence in Egypt, since it began to appear in 1899 up to the end of 1917, is shown in the next table. The population of Egypt in 1913 was 11,338,000, of whom 168,234 were foreigners.

The year 1916 yielded the largest number of reported cases, and, though this figure is higher than that for 1911, which comes second, the latter year gave the greatest number of deaths, namely, 1,041 as against 828 in 1916.

Plague in Egypt, 1899 *to* 1917.

Year.	Cases.	Deaths.	Case Mortality.
			Per cent.
1899 - - - - - -	93	45	48·4
1900 - - - - - -	127	60	47·2
1901 - - - - - -	205	102	49·7
1902 - - - - - -	481	291	60·5
1903 - - - - - -	303	160	52·8
1904 - - - - - -	854	501	58·6
1905 - - - - - -	266	181	68·0
1906 - - - - - -	631	475	75·3
1907 - - - - - -	1,253	914	72·9
1908 - - - - - -	1,511	780	51·6
1909 - - - - - -	513	207	40·3
1910 - - - - - -	1,238	615	49·7
1911 - - - - - -	1,656	1,041	62·9
1912 - - - - - -	884	441	49·9
1913 - - - - - -	654	304	46·5
1914 - - - - - -	219	111	50·7
1915 - - - - - -	235	120	51·0
1916 - - - - - -	1,702	828	48·6
1917 - - - - - -	732	399	54·5
Total in 19 years -	13,557	7,575	55·9

During the first seven months of 1918 the reported cases of plague in Egypt amounted to 311, of which 139, or 44·7 per cent., were fatal.

GREECE.

In July 1914 plague appeared in the seaport town of Piræus, and up to mid-September 14 cases and six deaths had been reported. It was stated in the Greek Official Gazette that the first cases occurred among persons who had recently arrived at Piræus from Chios or Mitylene. It has, however, to be remembered that in August and September of the previous year plague had occurred at Piræus, the early cases having been persons working in a local flour mill. Piræus was declared free from plague in December. The cases had been isolated in a hospital at Daphni, a village near the town. In January 1915 a single plague case was reported at Piræus, and another in August.

During September 1914 plague appeared at Salonica, three cases being recorded among the Greek troops and four among immigrants. There was no epidemic later, but in March and April 1915 about 12 more cases were reported in Salonica, some of those attacked being refugees from Asia Minor.

In September 1914 plague appeared among the Greek troops at Kara-Buran, at the mouth of the Gulf of Salonica, but no details of the occurrence have been received.

In October 1914 plague was officially reported to be present in the island of Mitylene, or Lesbos, in the Ægean Sea, 10 miles off the coast of Asia Minor, north of the Gulf of Smyrna. This island is at present occupied by the Greeks. In January 1915 some more cases occurred in Mitylene, the precise number of which has not been stated. In October the Greek Government informed the foreign Ministers at Athens that, as there had been no plague cases in Mitylene for a month, the sanitary measures enforced against the disease had been withdrawn.

During August 1914 plague was stated to be epidemic in the island of Chios (now Chio or Scio). which lies 7 miles from the mainland of Asia Minor, at the entrance to the Gulf of Smyrna; this island is now occupied by the Greeks. No details of this epidemic have as yet come to hand. Early in 1915 plague was still occurring in Chios. and reports in April and again in August referred to the continued presence of plague in the island.

The British Vice-Consul at Zante, one of the Ionian Islands, 9 miles from the coast of the Morea. reported on 4th August 1915 that plague of a mild type had made its appearance in the island. It is alleged that the infection was introduced into Zante from Cavalla by rats, which were found in a cargo of flour. Expert medical officers were despatched to Zante from Athens to aid in controlling the disease. Up to October, 24 cases were notified, of which 10 had been fatal. The wealthier inhabitants of the island fled in alarm as soon as they heard the nature of the prevalent malady.

In January 1916 an outbreak of what was said to be pneumonic plague occurred at Syra. the most important island of the Cyclades. and during that month 20 cases. 14 of which were fatal, came under notice. Two medical specialists sent from Athens to make investigations in Syra confirmed the diagnosis. In June 1916 plague was again reported at Chios, Mitylene, and also in September at Volo. a port in Thessaly, 37 miles from Larissa. A group of plague cases was also reported at Piræus, some of the attacks being among the military. The disease also appeared in sporadic form in Athens during 1916 and 1917, two of the cases in April of the latter year being soldiers, but the type of the illness was mild.

ITALY.

Early in September 1914 a localised outbreak of plague occurred in Sicily at the seaport town of Catania, 59 miles south-east of Messina. Altogether 17 cases were recorded. the diagnosis being confirmed by bacteriological examination. The earliest attacks were among the clerks and porters employed in the local Custom House who had handled cargo, including, it was suggested, raw hides from Alexandria, discharged by the s.s. "Polcevera." The measures applied to check the outbreak included isolation of the sick. segregation of contacts. disinfection of the town sewers, sanitary inspection of the wharves and harbour warehouses, trapping and poisoning of rats and prevention of access of rodents to ships, medical examination of all persons arriving at the port, and general supervision of the people residing in the infected parts of the town. The number of deaths which occurred in this plague outbreak has not been stated; but it is known that four patients died between 3rd and 7th September.

There is no record of plague in Italy during 1915, but on 6th November 1916 the s.s. "Sigmaringen" arrived at Catania from the plague-infected port of Karachi having on board the corpse of a member of the crew who had died of plague 36 hours before the ship's arrival in port. On medical inspection all on board were found well, and there appears to have been no unusual mortality or sickness among rats on the vessel. Catania is a seaport of Sicily, near the foot of Mount Etna, 50 miles by rail S.W. of Messina, and 54 miles N.N.W. of Syracuse.

So far as can be ascertained, there were no manifestations of plague in Italy during 1917.

In an article published in June 1919 in *L'Igiene Moderna*, Dr. Luigi Piras states that at the port of Genoa from 1903 to 1917 no less than 17 epizootics of plague were observed among the local rats in the warehouses and stores of that port, but in no instance was the infection transmitted from the rats to man. He does not state, however, in which of these years the epizootics in the rats occurred, nor their extent.

MALTA.

From 2nd March to 2nd April 1917 eight cases of plague, four of them fatal, occurred in Malta. Five of the cases were notified at Calcara, among a group of labourers from the neighbouring island of Gozo, the other three cases were contacts with the above, one being an attendant at the mortuary of the Central Hospital who had been present at a post-mortem on one of the fatal cases. The four persons first attacked worked as labourers in H.M. Dockyard; and in a pattern shop where one of them was employed, dead rats had been found. Afterwards about 1,000 rats were caught and examined, but only 15 of them were found to be infected with plague, all of them being found in the dockyard area. All the rats, except one, a *Mus decumanus*, were of the *Mus rattas*, or *M. Alexandrinus* species. The infection was probably due to the landing of infected rats from a ship arriving from an infected port. Large use was made of various poisons for the destruction of rats in Malta, and the kind which gave the best results was an "extrait toxique" obtained from the Pasteur Institute.

PORTUGAL.

Early in October 1914 a small localised outbreak of plague comprising eight cases, mostly of the pneumonic type, occurred in the Ajuda suburb of Lisbon. All the cases lived in the same street, and as the municipal authorities regarded every inhabitant of this street as contacts, the whole of them were isolated compulsorily for some days. The diagnosis of plague was bacteriologically confirmed. No official report has been published regarding this outbreak, nor has the number of deaths been stated, though, as the type was pneumonic, the mortality might be expected to be high. So far no information has come to hand as to the source of the outbreak in the Ajuda suburb, but it can only be surmised that as plague was prevalent at the time in the Portuguese Possession of the Azores, the infection had been conveyed by shipping to Lisbon.

SPAIN.

No definite report has been received as to the occurrence of plague in Spain during 1914, but on 9th October the Cuban Health Department officially declared quarantine for plague against all arrivals in Cuba from Barcelona, which, next to Cadiz, is the chief port of Spain. It was thought probable by epidemiologists at the time that possibly the enforcement of quarantine by Cuba against Barcelona was due to the fact that plague had appeared about the same time at Lisbon, as stated above. Later, however, a statement appeared in the Italian *Bollettino Sanitario* to the effect that three plague cases had occurred in Barcelona in June 1915 and that two of the patients had died, but making no mention of any previous plague cases during October 1914. The source of the above-mentioned three cases in June 1915 has not been disclosed.

GIBRALTAR.

On 1st February 1916 the s.s. " Scindia " arrived at Gibraltar, and the master reported the recent death of a patient on board and the illness of another, the symptoms in both having been suggestive of plague. The vessel had come from an Indian port and had landed a detachment of troops at Marseilles. It was further reported that two other deaths had occurred during the voyage, but whether from plague or some other disease could not be definitely determined.

ENGLAND AND WALES.

The Port of London.—No actual case of plague occurred in the Port of London during 1914, though one patient with pneumonia, suspected to be plague, was landed in June from the s.s. " Persia," from Bombay, and taken to the isolation hospital at Denton for observation and until bacteriological investigation had been carried out. The results, however, were negative as regards plague. It may be mentioned that before the above patient showed signs of illness, nine dead rats were found in one of the holds while cargo was being discharged. The ship was fumigated by sulphur dioxide, and bacteriological examination of the dead rats yielded only negative results.

Two other ships reported that a suspected case of plague had occurred during the voyage from India and had been landed at Suez:—(1) On the s.s. "Caledonia,"* when four days out from Bombay; one of the crew, a Goanese steward, developed bubonic plague. He was landed at Suez, and the diagnosis was bacterioscopically confirmed. No dead rats were found on board. The ship was disinfected at Suez before entering the Canal. All were found well on board on arrival of the vessel at the mouth of the Thames. (2) The s.s. "Malakand," from Calcutta, arrived in the port of London on 3rd December and reported that a suspected case of plague, which occurred during the voyage, had been landed at Suez on 17th November, but the evidence pointing to plague appears to have been but slight, and no information as to its being confirmed at Suez has been received. The case, therefore, seems only to have been one of suspicion. No dead rats had been observed on the ship, and on arrival at Gravesend all on board were found to be well.

Another vessel, the s.s. "Kilchattan," arrived in the Thames after having landed a suspected case at Bristol, but the diagnosis of plague was negatived by bacteriological investigation. (*See* Bristol.)

During 1914 a total of 42,916 rats were destroyed at the port of London, namely, 12,955 in dock warehouses, 8,683 on vessels during the voyage, and 21,278 on ships while in dock or in the Thames. This makes a grand total of 837,097 rats destroyed at the port since 1901. Of the 42,916 rats killed during 1914, 2,716 were bacteriologically examined, but none were found to be plague-infected. It is a matter for regret that the Port of London Dock Authorities still remain indifferent to the necessity of rendering rat-proof all the shore buildings in which foodstuffs are stored.†

It may be mentioned that in 1913 seven infected rats were found in the London Docks; and in each of the previous five years the presence of plague among the dock rats had been proved by bacterioscopic examination, though the number of infected animals was but small.

During 1915, 30,648 rats were destroyed in the Port of London, namely, 11,269 in the dock warehouses and 19,379 in ships in the docks and on the voyage; 2,776 rats were examined, but none were found infected. As regards the variety of rats killed, 2,142 were *Mus decumanus*, 554 *M. rattus*, 77 *M. Alexandrinus*, and three *Mus musculus*.

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* The s.s. "Caledonia" had called at Plymouth on 12th March *en route* or London, and reported the landing of the suspected case at Suez.

† Annual Report of the Medical Officer of Health for the Port of London for the Year 1914, by Dr. Herbert Williams.

During the early days of October 1916 a plague-infected rat was discovered in a shed in the Royal Albert Dock, the diagnosis being bacteriologically confirmed. This shed had corrugated iron walls and a wooden floor; there was a space beneath floor open for rats to come and go to the banks outside on the north. The shed was infested by rats, and the scanty contents, at the time the infected rat was found, included grain sweepings in bags. From 5th October to 6th November 1916, out of 601 rats examined, four were found infected by plague.

During 1917 two vessels arrived from Bombay in the Thames having had cases of plague on board during the voyage, namely: (1) the s.s. " Sardinia, and (2) the s.s. " Matiana."

(1) S.S. " Sardinia " from Australian ports had called at Bombay and remained there several days taking on board a cargo of grain, pulse, &c. She called at Marseilles on her way to England and discharged some of her cargo there; afterwards she was " Claytonised " for destruction of rats in conformity with the regulations of the Marseilles Port Sanitary Authority. The " Sardinia " touched at Gibraltar and arrived off Falmouth on 1st May, and landed her captain, who was suffering from heart disease. The ship's surgeon informed the port medical officer that he had two lascars suffering from " mumps." Later in the day attempts were made to send one of the " mumps " patients to hospital on shore, but he died on board the tender and was taken back to the " Sardinia," which sailed for the Port of London. The body of the dead lascar was buried at sea, as also was the second " mumps " patient, who died shortly after leaving Falmouth. Meanwhile the Falmouth port medical officer telegraphed his suspicions of plague to the Local Government Board, which at once warned the Medical Officer of the London Port Sanitary Authority. On arrival off Gravesend on 2nd May, three other members of the crew of the " Sardinia " were found to be suffering from plague, one of whom died before he could be removed to the port hospital at Denton. The others were landed and isolated, as were also some members of the crew who had been in contact with the previous cases. Two of the " contacts " developed plague while under observation, making a total of seven cases, of which five were fatal, occurring between 27th April and 6th May. Six of the cases were lascars, the seventh being a British storekeeper, who recovered. Another suspected case was found after careful inquiry not to be suffering from plague. A sick rat, it was stated, had been seen on the vessel after leaving Marseilles. Though the ship had sailed from a plague-infected port (Bombay) on 9th March, no plague developed on board until towards the end of April, and shortly before it reached the shores of England, and notwithstanding that the ship's holds had been disinfected (or " deratised ") by Clayton's apparatus at Marseilles. The probable explanation of these facts will be considered with the case of the " Matiana."

All the plague cases occurred in the fore part of the ship. The store of food for the natives was kept in the forepeak. The British storekeeper lived in a cabin opening into the starboard forecastle alleyway. After the ship left Marseilles, three dead rats were found in a storeroom adjoining the food store, their deaths being assigned to the fumigation which was done at Marseilles, but from the position in which they were found the fumes of the Clayton gas pumped into the holds could not have reached the rats in the storeroom.

(2) The s.s. "Matiana" left Bombay on 9th June and touched at Delagoa Bay, where she remained from 26th June to 6th July, and where some of her cargo was landed, the holds afterwards being fumigated with sulphur according to the Portuguese regulations. The vessel arrived off Falmouth on 11th August and reached the mouth of the Thames on 13th August. Between 14th July and 28th nine cases of plague occurred on the "Matiana," all natives of India, and six of them died. At Gravesend, three convalescents were landed and taken to the port hospital. After the ship's arrival a tenth case occurred, and terminated fatally, making altogether 10 cases and seven deaths. All of the cases, except one, belonged to a part of the crew berthed between decks. After deaths from plague had taken place at sea on the vessel, the forecastle was cleaned out and during the process 10 dead rats were found, and one in the native food store; one of the 10 dead rats was found in a bundle of clothing which had belonged to one of the lascars who had died of plague. The main cargo of the "Matiana" consisted of oil seeds and other things that attract rats, and had been put on board at Bombay.

The history of these two ships was similar: both had loaded cargo attractive to rats at the infected port of Bombay; both had landed some cargo at an intermediate port, and the holds had been afterwards fumigated. In both instances plague did not occur on board till about a week or more after this fumigation had taken place, when the disease manifested itself among the native crew. It may be concluded therefore that infected rats went on board these two ships at Bombay and that the process of fumigating the partly emptied holds at the intermediate ports drove the rats out of the holds into the quarters occupied by the native crews, close to which their food supplies were stored. So long as the infected rats remained in the holds the crews were not specially exposed to the infection, but when they reached the native crews' quarters the rat-fleas had opportunities of biting the natives and transmitting the plague infection to them.

It may be added that owing to the measures taken at the Port of London under the direction of Dr. Willoughby, the Port Medical Officer of Health, no extension of the plague infection occurred beyond the ships, and, so far as can be ascertained, no infected rats succeeded in getting ashore.

During the year 1917, 38,106 rats were caught in the London Port sanitary district, 2,916 were examined bacteriologically, but only two were found infected, namely, one in January and one in March.

Liverpool.—During the month of July 1914, Dr. Hope, the Medical Officer of Health for the city of Liverpool, was informed by a medical man that several cases of an illness suspiciously resembling plague had come under his notice, all being members of one family. The patients were removed to hospital and bacteriological investigation was at once instituted, with the result that the diagnosis of plague was confirmed. The father of this family was employed by a cattle-food milling firm in Liverpool, and was chiefly engaged at a crushing machine for linseed and various kinds of grain, manioc root, etc. He came home from work feeling ill on 13th July and, though medical advice was sought, he died on 20th July. About 30th July his wife and several of the children fell ill and, as suspicions had by this time been roused, Dr. Hope was notified of the occurrence of the cases, and his assistance invoked to settle the diagnosis. The whole family was removed to the isolation hospital, as also was a little boy who frequently visited the house and who also had become ill. So that, in all, 10 cases of plague were recognised, including the father, mother, and seven children, along with the boy-playmate of these children. Four cases proved fatal, including the father who died before bacteriological evidence of the nature of the disease had been obtained. Dr. Hope presumes that this man was infected at his place of work by a flea or fleas derived from rats which had come to Liverpool on shipboard from some infected place abroad.

When these facts were communicated by Dr. Hope to the Local Government Board, Dr. Wilkinson, one of their Medical Inspectors (who was formerly Sanitary Commissioner for the Punjab and who had had a wide and varied experience of plague), was sent to Liverpool to make inquiries. He found no evidence of infected rats in the house of the family that had been attacked by plague, but he noticed abundant traces of fleas, all the surviving members of the family showing extensive marks of recent flea-bites. This suggested that the infection had been transmitted by human fleas from the first plague case to the others. The father of the family, it is surmised, had been bitten at his work by an infected rat-flea from a rat that had come ashore at Liverpool from a ship that had arrived recently from an infected port. This suggestion appears important from the epidemiological point of view, as hitherto there has been little evidence of the spread of plague by the agency of human fleas.

This localised outbreak was promptly and satisfactorily dealt with under Dr. Hope's direction and no extension of the infection occurred. Careful observation was maintained for the detection of suspicious cases in man and rats for the rest of the year.

In the city of Liverpool during 1914, 13,868 rats were caught and destroyed; of this number, 3,430 were bacteriologically examined, but no trace of plague infection was found.* In the port of Liverpool 11,027 rats were caught on ships and on the quays, the combined returns including the rodents caught by the shipping firms and rat-catching companies, giving a total of 77,460 rats destroyed during the year. Systematic examination of ships from foreign ports, with a view to detect the presence of rat plague on board, showed that on several vessels unusual mortality among rats had been observed, but the bodies of the animals available on arrival for bacteriological purposes were mostly in such a state of decomposition as to be useless for laboratory examination. On the s.s. "Sailor Prince," which arrived at Liverpool on 11th January 1914, from Beirut and other Syrian ports, two plague-infected rats were discovered, as also two others which were regarded as "suspicious." The s.s. "Hypatia," from Buenos Aires and the River Plate *viâ* Hamburg, arrived at the Port of Liverpool on 8th January, and reported that while at Hamburg, a few days before, several infected rats had been found when the hatches were opened. The ship was fumigated by the German authorities by the Nocht and Giemsa method and afterward with sulphur dioxide, and a certificate to this effect was produced by the Master at Liverpool. After arrival, five more rats were caught by trapping in a part of the vessel which could not be fumigated. But none of these animals showed any signs of plague. During the month of March, the s.s. "Ville de Paris" arrived at Liverpool from Callao and other Chilian ports, and a rat-catcher, as usual, went on board. He reported that there had been an unusual mortality among rats on the ship; 14 of the dead animals were sent to the municipal bacteriologist, who found the appearances suspicious of plague. Three dead rats were discovered *in bags* of cotton seed during the process of unloading. The ship was then thoroughly fumigated. Altogether, 148 dead rats were collected on this ship before or after the fumigation, but most of them were too decomposed to permit of bacteriological examination. This vessel had been fumigated three times before arrival at Liverpool, namely, once at Ilo, then at Callao, and the third time at Arica. No actual or suspected human case of plague had occurred on the ship.

During 1914, 107 ships were fumigated, when empty, for the destruction of rats. A search instituted on these vessels after the fumigation process gave an average of 34 dead animals per ship.

Liverpool, with its large amount of shipping with the East and with ports of South America, is particularly liable to the importation of infected rats; but the Port Sanitary Authority has so far met the danger with success, only a few instances having occurred in past years where the infection had succeeded in effecting a landing, but only for a short time, the vigorous measures hitherto employed having been always effectual in extinguishing the danger within a short period.

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* Report on the Health of the City of Liverpool during 1914, by Dr. E. W. Hope, Medical Officer of Health.

In September 1915 some plague-infected rats were found in a warehouse in the Liverpool docks, and later a guinea pig, which had purposely been let loose to attract infected fleas, was found infected; as also another rat. From 1st October to 31st December 1915, 6,451 rats were caught in the city and port and, of these, 2,771 were bacteriologically examined, none being found infected. During 1915, 53 vessels were fumigated for rat destruction as compared with 107 in 1914.

During September 1916 human plague was again discovered in Liverpool, six cases and four deaths being reported, in three separate families. In one of these the man first attacked worked at a grain warehouse on the Liverpool Dock Estate, in which some half a dozen plague-infected rats were found. In another of the families a woman who contracted plague worked in a rag warehouse. No apparent connection could be traced between the three infected families. There is some evidence that a steamship which arrived on 8th September from Rosario with a cargo of maize may have brought plague-infection to Liverpool. Some of the maize reached the warehouse at which the man mentioned above worked and, on search being instituted after his illness began, six infected rats were found in and around the warehouse. Owing to the active measures undertaken by the Health Department of Liverpool, the outbreak was quickly controlled and no further extension took place. Dr. Wilkinson again visited Liverpool and conferred with Dr. Hope on behalf of the Local Government Board. During 1916 one plague suspected vessel arrived at the Port of Liverpool, namely, the s.s. "Scindia" from Bombay. This vessel, on her voyage to England, called at Gibraltar, and one of the native crew died there from plague. On the ship's arrival at Liverpool, careful examination was made of the whole ship and as to the health of each member of the crew. All persons on board were found well, but subsequently a native member of the crew fell ill and was removed to the port isolation hospital for observation, but his case was definitely proved not to be plague. During 1916, 70 vessels were fumigated for destruction of rats, and after the operation a total of 2,115 dead rodents were found: including these, the total number of rats destroyed on ships and on the quays by the rat-catchers employed by the Port Sanitary Authority was 53,797. In addition, many rats were killed by the various shipping companies who employ rat-catchers; and also the Zeba Ratcatching Company destroyed many rodents on vessels in the docks. The total number of rats destroyed on quays and vessels in the port was 73,358, and in warehouses, sewers and other places in the city, 13,662, making a grand total of 87,020 rats destroyed in Liverpool during the year; of these, 10,433 were submitted to examination by the Municipal bacteriologist.

During March 1917 a rat found on the first floor of a railway warehouse at Duke's Dock, Liverpool, was proved to be infected by plague as a result of examination by the City bacteriologist. The dock warehouse where the rat was found is isolated practically on a peninsula, and in the proximity of the warehouse which, in the October of the previous year, had been found infected by rat plague. This group of warehouses had been constantly the scene of rat hunts for the last seven months. Further search during March 1917 brought to light one more dead rat, which was sent to the City Laboratory for examination, but found to be negative. Both of these dead rats were found in loose empty sacks.

The number of rats caught in Liverpool city and port during 1917 was 21,767,* of which 9,068 were examined and only one rat was found infected, that already mentioned which was discovered in March.

A ship, the s.s. "Benefactor," arrived at Liverpool in October 1917 and reported having had two cases of plague on board while loading cargo at Bombay for England. The men were landed there and taken to hospital, the diagnosis of plague being fully established by examination. All the crew were in good health when the vessel arrived in the Mersey, and no trace of human or rat plague on board was discovered by the officers of the Port Sanitary Authority.

Bristol.—During November 1914 a single suspected case of plague was landed at the port of Bristol from the s.s. "Kilchattan" which had arrived on that date from Bombay. The patient was isolated in the port hospital, and material taken from him was bacterioscopically examined. Samples were also sent to the Board's bacteriologist, who reported that, "microscopically, in culture and as a result of animal inoculation, the results were negative as regards plague." There was, it appears, no evidence of rat infection on board the ship, though a number of these animals were caught and submitted to examination. The number of rats on the "Kilchattan" is said to have been comparatively small.

During 1915 there was no reported occurrence of human or rat plague in Bristol; but, as will be presently seen, the disease appeared in this city in 1916.

During August 1916 four cases of human plague occurred in the city of Bristol, all of whom recovered. Two of the patients, father and son, worked in a rag warehouse where rags, collected in the city and surrounding district, were stored. According to a report by Dr. Davies, the Medical Officer of Health, there were at the time 200 tons of rags in this warehouse, which was swarming with rats and fleas. Another of the patients was a Corporation dustman who had visited the warehouse in the course of his duty. Of 61 rats examined bacteriologically, six were found infected by plague. The trapping and examination of rats were continued for six months and some 9,000 were caught, but no other infected animals were discovered. The precise source of the outbreak was not definitely determined but three different theories were put forward, namely (1) that the outbreak was due to infected rags; (2) that one or more plague-infected rats had escaped from a ship which had come from a foreign port and had either found refuge in the rag warehouse, or had infected other rats which infested that place, and (3) that the Germans had succeeded in letting loose in Bristol artificially infected rats with a view of creating a panic. As regards (2), which appears the most probable, it may be mentioned that the majority of the rats in Bristol are of the brown variety (*Mus decumanus*), while the rats found on foreign ships belong to the black variety (*Mus rattus*) which is common in India and the Far East. The particular flea which infests *Mus rattus* is known as *Xenopsylla cheopis*, or the Indian rat-flea. It is, therefore, of interest to mention that, on one of the English brown rats (*M. decumanus*) found infected, there was discovered an Indian rat-flea which might have come from an infected ship rat. All the fleas found on the other rats were the *Ceratophyllus fasciatus*, or brown rat-flea. In dealing with this outbreak, Dr. Reece, Assistant Medical Officer of the Local Government Board, proceeded at once to Bristol to assist the local officials; and Dr. Farrar, one of the Medical Inspectors, subsequently continued the investigation. One of the Board's bacteriologists, Dr. Griffiths, gave valuable help in examining rats in the Bristol docks and on board vessels in the port; but, as has been said, no infected rats were found beyond those discovered (all *Mus decumanus*) in the rag warehouse. The contents of the rag warehouse after chemical disinfection, were burnt in the city refuse-destructor, the men employed in this work being protected by prophylactic inoculation.

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* These figures do not include rats caught or destroyed by various shipping firms employing their own rat-catchers, or rat-catching companies

On 22nd June 1917 the s.s. "El Cordobes" arrived at Avonmouth Dock from Buenos Aires with a cargo of meat, maize, beans, &c. On lifting the hatches of one of the holds on 25th June, about 50 dead rats were found and were at once burnt in the boiler of the donkey engine, the fact being reported to the Bristol Port Sanitary Authority. The Assistant Port Medical Officer of Health at once gave instructions to prevent any danger if plague were found to be present, and on inquiry, found out that during the voyage rats came up on deck and died. Precautions were taken day and night to prevent rats from the ship reaching the shore. On search being made, 35 more rats were found, and subsequently 124 others. Samples of them were sent to the city bacteriologist for examination, who failed to discover any traces of plague, and in this he was corroborated by Dr. Eastwood, the official bacteriologist of the

Board. An organism of the B. enteritidis group was, however, found, and it is probable that the unusual mortality observed among the rats on the s.s. "El Cordobes" was due to this organism and not to plague.

Hull.—On 22nd August 1916, Dr. Mason, the Medical Officer of Health for the port of Hull, received information that a lad, aged 17, who fell ill on 19th August, had died, and that a post-mortem examination led to a diagnosis of plague. Another lad who had been working with the deceased on a ship in dock was ill with similar symptoms at the time. This second case was removed to the isolation hospital. The ship on which they had been working was the s.s. "Keneh," which had been used as a pilgrim ship. This vessel arrived at Dundee from Alexandria on 16th June and, after discharging a cargo of jute and cotton seed, sailed for Hull. On arrival on 18th July she went into dock for extensive repairs. All on board had been certified as in good health, and the crew were paid off. It was known that a number of rats were on board, but no steps had been taken to destroy them. The "Keneh" had been fumigated at Alexandria about six months ago as a routine measure. On 23rd August, when search was made by the port officials, three decomposed rats were found, and further search on 24th August revealed four others in a mummified condition. Two apparently healthy rats were caught in the traps that had been set. The party of workmen engaged in repairing the "Keneh" numbered 40. The boys had been employed in scraping the interior of the holds. It is presumed that they were bitten by rat-fleas while at their work. Every precaution was taken and Dr. Farrar was sent by the Board to confer with the Hull port officials as to carrying out preventive measures. All the other workers on the ship received prophylactic inoculations. Rats were systematically trapped in the docks and examined, but no infected animals were discovered during 1916.

In March 1917, among the rats examined two were proved by bacteriological investigation to be infected by plague. During the whole year, 4,955 rats were caught, and 815 were examined; only two, as has been said, showed signs of plague infection. These two were found in March, one being *Mus rattus* and the other *Mus Alexandrinus*, presumably foreign rats that had arrived on shipboard at the port.

On 28th March 1918 the s.s. "Morocco" arrived at Hull from Bombay. After medical inspection all were found well, except a Swedish sailor, who was suffering from an injury to one of his eyes. Rat-catchers proceeded to destroy the rats on board, and over 60 were trapped, killed, or found dead. On 4th April eight rats were found, namely, five *M. Alexandrinus* and three *M. rattus*. Four of these were sent to the Local Government Board, whose bacteriologist, after the application of the usual tests, including cultures and animal inoculations, reported that one was distinctly infected by plague, and that two of the others were regarded as probably infected. There were, however, no subsequent developments of plague in man or rats at the Port of Hull.

East Suffolk.—Early in October 1914 a rabbit was discovered in a dying condition near the Royal Naval Barracks, Shotley, East Suffolk, and on examination by the official bacteriologist it was proved to have been suffering from plague. Towards the end of the same month a dead rat was found near the sick quarters of the Shotley Barracks, and laboratory examination showed that it was infected with plague. Early in the following month (November) four other dead rats were found in a field at Shotley, but as they were in an advanced state of decomposition they could not be submitted to bacteriological tests; but the post-mortem appearances seemed to suggest that death had been due to plague.

The presence of plague among rats in East Suffolk has been demonstrated each year since 1910. It may be remembered that in that year a group of four human fatal plague cases occurred in the locality; in 1911 a single case occurred at Shotley Barracks in the person of a sailor, who had cut his forefinger while cleaning a rabbit which he had caught in the neighbourhood of the Barracks.

It is more than probable that the introduction of plague into East Suffolk was due to grain ships from infected ports arriving in the River Orwell for Ipswich, and from which vessels rats came ashore and infected the local rodents with plague. It may be well to repeat here what has elsewhere been stated, namely, that of late years the number of black rats (*Mus rattus*, or Indian rat) has greatly increased at the Port of Ipswich. The dock labourers call them " the foreigners."

In June 1918 two fatal cases of illness regarded as pneumonic plague occurred at Erwarton in the previously infected area of East Suffolk. Bacteriological examination of material obtained from one of the cases confirmed the diagnosis of plague. The two persons attacked were women residing in a pair of semi-detached cottages some distance from any other dwellings. One of the patients died on 13th June and the other on 19th June, the latter had nursed the former, from whom she had evidently contracted the infection. The precise origin of these cases was not definitely traced, but the fact that they occurred in the previously infected area suggests the presence of the disease in the local rats or other rodents.

HOLLAND.

In January 1914 a plague-infected rat was found on shore near the docks at Amsterdam; in April another infected rodent was discovered, and yet another in May.

On 26th February 1914 the s.s. "Bishopsgate," from San Nicholas and the River Plate, arrived at Amsterdam with a cargo of grain, and during the process of unloading an infected rat was found in one of the holds. A similar occurrence had been reported in 1913 at Amsterdam on board two ships, both from Argentine ports.* Fortunately, there was no human plague in Amsterdam or any other place in Holland during 1914.

No cases of plague in rat or man occurred in Holland during 1915, 1916, or 1917.

AUSTRIA-HUNGARY.

In some London newspapers of 22nd May 1917, a statement appeared to the effect that the Viennese papers reported the occurrence of several cases of plague at Agram, the capital of the Hungarian province of Croatia Slavonia, and situated 142 miles north-east of the port of Fiume. Beyond the fact that three of the cases had proved fatal, no other details have been published.

RUSSIA.

The Government of Astrachan.—As has been pointed out in previous reports, plague is endemic in this Government, and this endemicity is believed to be associated with a plague enzootic among the spermophiles, or steppe-marmots, locally known as "susliks." The human disease shows itself chiefly among the nomadic tribes occupying the Kirghese and Kalmuk steppes, and is usually seen in the pneumonic or septicæmic form. The information for 1914, since the outbreak of war, as to cases and deaths is very scanty, but up to August there had been 56 cases (and 46 deaths); of these 35 (30) were referred to the Kirghese, and 21 (16) to the Kalmuk steppes. From Astrachan it is alleged the infection was carried on shipboard across the Caspian Sea to Baku and its vicinity, on the peninsula of Aspheron, on the shores of which are fisheries, in which men from the Astrachan coast are employed, there being a constant interchange between the two shores. In April 1914 plague appeared in a Tartar family at the village of Tourkian (or Tourkend) which lies a short distance from Baku and its petroleum oilfields. From this family the infection spread to seven other families related to it, and some 19 individuals were attacked, of whom 14 died. It is alleged that the district around Baku is infested with rats and mice in considerable numbers, but there is no evidence to show that these were infected in 1914. A single case of plague was reported in February 1914 in the town of Saratoff, on the River Volga: this was probably an importation from Astrachan.

In *Ural territory*, which adjoins that of Astrachan, plague reappeared, in the arrondissement of Lbistchensk, in March 1914, having also been present at the end of 1913: during that month

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* Dr. R. W. Johnstone's Report to the Local Government Board on the Progress and Diffusion of Plague throughout the World during the year 1913, page 58.

17 cases and 16 deaths were reported, the number of cases and deaths in November of the previous year having been respectively 206 and 170.

It was stated in the *Bulletin de l'Office International d'Hygiène Publique* that plague had attacked four persons in the city of Moscow during the month of December 1914, and five in January and February 1915, but there has been no confirmation of the statement from official sources. In Eastern Siberia plague was reported to be present in October 1915 in the Transbaikal province, at a village 50 miles to the westward of the Manchurian frontier; 16 cases were observed, of which 13 were fatal. A London newspaper of 26th February 1915 stated that bubonic plague was occurring in the Caucasus. There are no official reports as to plague in Russia during 1916 and 1917, due probably, in the first instance, to the war, and, latterly, to the dislocation of the health administration through the revolution.

Rumours in the press at the end of 1917 and beginning of 1918 were to the effect that plague was prevalent in Petrograd, but no details have been given or confirmation obtained.

TURKEY IN ASIA.

From July to October 1914 scattered cases of plague were reported at Smyrna, but not in large numbers, and in July the presence of the disease at Adalia, on the south coast of Asia Minor, was also observed. In Syria plague appeared at Beirut in May, and cases continued to be reported up to November. In June and July a number of persons at Jaffa were attacked by plague, also at Tripoli de Syria, and Haifa, another Syrian port; none of these outbreaks, however, was of a serious kind. Plague also appeared on several islands off the coast of Asia Minor, including Rhodes (which is occupied by the Italians), Chios, and Mitylene (occupied at present by the Greeks).

In Mesopotamia plague appeared at Basra in May 1914 and continued to be prevalent during June and July, and about this time infected rats were found in the town. A case of plague was discovered in July on board a Turkish ship, the s.s. "Bagdad," when it called at Kout, and on the arrival of this vessel at Bagdad, a little later, another plague patient was landed. After this, up to October 1914, scattered cases were recorded in the city of Bagdad, to the number of 32, of which 17 proved fatal.

In January 1915 plague became epidemic in the city and province of Bagdad, and the prevalence lasted until June. It is estimated that during the first half of 1915 more than 1,700 persons were attacked by plague in this locality, and 1,300 of them are stated to have died. Among the places invaded by the disease were Azameth, Hillé or Hillah, Khanakin, Kerbella, Samawa, &c.

At Kasimieh, in Syria, from March to May, 29 cases were reported, of which 28 terminated fatally.

On the Red Sea coast of Arabia in 1914 plague appeared, as usual, in the early part of the year, at Jeddah, but there appears to have been no widespread epidemic; and in the spring of 1915 some cases of plague were reported again at Jeddah, but no details have been forthcoming.

In October 1915 the presence of plague again at Beirut was announced, but no particulars were given as to the number of cases and deaths.

Little has been heard from Asiatic Turkey in 1916 and 1917 as to plague, except that the disease was present in December at Trebizond, the capital of the province of that name, and a flourishing Black Sea port with a population of about 50,000.

ADEN.

In 1916 three cases of plague were landed at the port of Aden from the s.s. "Syria" on 4th January and taken to hospital. The vessel had come from Bombay. There appears to have been no spread of the disease from these cases. But in 1917 there was a prevalence of plague in the district of Aden, 122 cases and 91 deaths being reported. All the cases were removed to the hospital on Twin Island; invaded houses were disinfected, and contacts were segregated; all dead bodies were examined for traces of plague by medical men in the Government Service, or by private practitioners in different parts of the district.

One ship was fumigated by means of Clayton's apparatus on account of the occurrence of a case of plague on board and the finding of dead rats in the vessel.

The plague outbreak in Aden in 1917 began early in April and the first cases were observed among the coal porters of the firm of Cory Brothers.

On 17th February 1918 a case of plague was landed at Aden from the s.s. "Prosper," which had come from Bombay, but there does not appear to have been any spread of the infection at the time. In the week ended 28th May 1918 a death was certified from plague at Aden, but whether it had been landed from a ship, or not, is not reported.

THE BAHREIN ISLANDS.

At the end of 1914 and the beginning of 1915 plague was prevalent in the Bahrein Islands, which are situated off the coast of Arabia in the Persian Gulf. These islands are under the protection of Great Britain and have a population of about 110,000. The British Political Agent in his annual report on the trade of the Bahrein Islands for the year ended 31st March 1915, states that during the winter of 1914 and spring of 1915 about 4,000 persons died of plague in the islands, and that many of the inhabitants had fled in panic from their homes to escape the infection.

There have been no reports as to the occurrence of plague in the Bahrein Islands during the second half of 1915 or 1916. But in April 1917 the disease was said to be still present in these islands, and up to the middle of May, 766 deaths had been caused by the epidemic.

OMAN.

Early in February 1914 plague was reported to be present at Debai, or Dibai, a town of about 10,000 inhabitants situated on the coast of Trucial Oman, in the Persian Gulf, known sometimes as "the Pirate Coast." Cases continued to occur up to the end of July, but the number of attacks and deaths has not been stated. It may be mentioned that before this time plague had appeared at Debai, namely, in 1911 and in 1913. There is no information as to the occurrence of plague in Oman during 1916 and 1917.

PERSIA.

In March 1914 plague was reported as having appeared in the Persian port of Lingah, near the entrance of the Persian Gulf, but apparently no epidemic occurred. In October and November the disease broke out at Tchakerli (or Chekerlieh), near Hassan Khanlon, about 30 versts from the Russian frontier, 96 cases and 80 deaths being reported. The outbreak was cut short by burning down the invaded houses. At the end of October plague was also present in the vicinity of Belessavar (or Bilessevar), in the Province of Azerbijan, in the north-west of Persia, and cases were also reported there during November. Owing to the very unsettled state of the country, the information received regarding these outbreaks is very meagre and incomplete. Some suspected cases were also heard of in Kasrishirin, 90 miles west of Kermanshah and close to the Turkish frontier (about 100 miles from Bagdad), among a party of travellers from Mesopotamia.

Early in January 1915 a report was received that plague had broken out in Tehran, the capital of Persia, but no details were given.

At the International Sanitary Council at Tehran on 6th April 1915 it was stated that 14 deaths from plague had already occurred at Bushire, one of the principal ports in the Persian Gulf, and on 26th April it was mentioned that three fatal cases had occurred on board the s.s. "Sardar," two other fatal cases having been previously reported on the same ship on its arrival at Bundar Abbas, another port in the Persian Gulf.

The s.s. "Sardar" had come from the Bahrein Islands, where plague was then prevalent. Also, during April 1915, three cases of plague were recorded as having occurred at the river port of Mohammerah, which is situated on the Lower Karun, near the Turkish frontier, 38 kilometres south of Basra, and at the junction of the waters of the Euphrates and Tigris, which discharge by the Shatt-el-Arab into the Persian Gulf.

In May 1916 plague broke out in the province of Ghilan, at Recht, or Resht, which is situated on the south-west shore of the Caspian Sea. During the first half of the month 20 cases and 14 deaths were reported. Plague continued to appear in Mohammerah during 1916, and, up to the end of July, 130 cases and 58 deaths were recorded. In April 1917 plague was still present in Mohammerah, and up to the beginning of June had attacked 65 persons, of whom 27 died. Plague also appeared at Charack, a town on the coast of the Persian Gulf not far from Lingah, but no details of this outbreak have been received.

II.—THE MANIFESTATIONS

OF

CHOLERA

throughout the WORLD during the years 1914, 1915, 1916 and 1917.

CONTENTS.

II.—CHOLERA.

PAGE

A.

Assam 199
Austria-Hungary 235

B.

Baluchistan 217
Belgium 233
Bengal 158
Bihar and Orissa 167
Bombay Presidency 176
Bombay City 181
British Islands 232
Bulgaria 239
Burma 202

C.

Calcutta 163
Central Provinces and Berar 192
Central India Agency 208
Ceylon 218
China 225
Chittagong 167
Coorg 214
Corea 228

D.

Delhi 214
Dutch East Indies 219

E.

Egypt and the Soudan 242

F.

Federated Malay States 221
France 234
French Settlements in India 217
French Somaliland 244
Formosa 228

G.

Germany 234
Greece 240

PAGE

H.

Hawaiian Islands 232
Hyderabad State 216

I.

India 155
Indo-China 222
Italy 241

J.

Japan 226

M.

Macao 226
Madras Presidency 171
Madras City 174
Mysore 215

N.

North-West Frontier Province 196

P.

Persia 246
Philippine Islands 228
Punjab 188

R.

Rajputana and Ajmer-Merwara 210
Roumania 239
Russia 237
Rangoon 203

S.

Serbia 239
Siam 221
Straits Settlements 220

T.

Tunis 241
Turkey 244

U.

United Provinces of Agra and Oudh. 183

INDIA.

For cholera, as for plague, India has been one of the chief scenes of its prevalence in the past; it is however, gratifying to know that cholera in recent years has become less prevalent than formerly. This reduction is due to some extent to the progress made in preventing the specific contamination of sources of water supply. In some provinces the spread of the infection is facilitated by the religious fairs and pilgrimages which are so common in India; but a great deal is now being done to cope with this danger by careful preparations beforehand for the accommodation of large multitudes of people on circumscribed areas for short periods, including the provision of temporary water supplies protected from pollution, adequate latrine provision, shelters and lodging places for pilgrims, as well as arrangements for the sale of wholesome food, &c. The throwing of cholera corpses into the rivers in certain parts of India is also blamed by some persons for spreading the disease. Apart from contaminated water supplies, and the infection of milk and other food and drink by flies, there remains the more difficult question of the spread of cholera by chronic carriers, and their detection before they can do much mischief.

So far as can be ascertained from the official returns of mortality for British India, there were, in 1914, 280,730 deaths from cholera as compared with 294,815 in the previous year, and 407,769 in 1912. The figures for 1914 are incomplete, for they do not include any cholera deaths that may have occurred in Baluchistan and Coorg, nor those in the Native State of Kashmir. But if the cholera deaths occurring in the States of Hyderabad and Mysore are added to those in the British districts of India the total mortality registered from the disease in 1914 amounted to 287,470. The provinces which suffered most from the ravages of cholera during the year were Bengal, with nearly 90,000 fatal cases, and Madras with more than 68,000. The cholera mortality-rate for 1914 in British India was 1·18 per 1,000 of the population.

During 1915 cholera was again prevalent in British India and in increased amount, the deaths numbering 404,472. As in the previous year, Bengal again suffered most, for 130,679 fatal cases were recorded, the United Provinces of Agra and Oudh coming next with over 90,000 deaths, while Bihar and Orissa took the third place with more than 88,000 fatal cases. The cholera mortality-rate in British India in 1915 was 1·70 per 1,000 of the population.

During 1916, in 13 provinces of British India, 288,047 cholera deaths were recorded, but, in addition, Central India had 5,474 deaths, and the Native States of Hyderabad and Mysore had, respectively, 1,475 and 137, making a grand total for the year of 295,133 deaths from cholera in the Indian provinces and States from which reports have been received. The provinces which yielded the largest number of cholera deaths in 1916 were Bihar and Orissa, which returned 90,582: Bengal, 70,836: and the Central Provinces, 39,205, the cholera death-rates in the three provinces being respectively 2·6, 1·56, and 2·82 per 1,000 of the population.

In 1917, in eleven Indian provinces from which, at the time of writing, reports had been received, 267,002 deaths from cholera were recorded, Bihar and Orissa province having again, as in the previous year, the largest number of such deaths, namely, 109,620, Madras coming next with 58,939, and Bengal being third with 45,021. In addition there were 7,288 deaths from cholera in the Native State of Mysore, 2,579 in Hyderabad, 589 in Central India, and 69 in Rajputana, making a grand total of 277,527 deaths from cholera in India. But these figures do not include cholera deaths that occurred in other Native States from which records are not available. The death-rate from cholera in British India for 1917 was 1·12 per 1,000 of the population as compared with 1·21 in 1916, 1·70 in 1915, and 1·18 in 1914.

In reviewing the recent experience of cholera gained in India, it appears that confirmation has been given to the opinion already expressed by some experts, namely, that the spread of the malady in India is associated to a large extent with human carriers of the infection, and that peculiarly favourable opportunities for diffusing the disease, often on a considerable scale, are afforded by the large assemblies of natives at their religious gatherings, bathing fairs, and pilgrimages, which form so large a part in the life of the Indian people. It has also been suggested that cholera carriers exist among the large bodies of ascetics, devotees, and beggars who spend their lives in travelling from one shrine to another, and from fair to fair. It is not difficult to conceive that cholera infection, brought by one or more carriers to a shrine at which thousands of natives are assembled, would quickly spread in the confined area in which, at the time of pilgrimage, it is almost impossible to secure the purity of local water supplies, or to avoid specific contamination of the sacred bathing places, or to maintain freedom from pollution of the surface soil. In addition, it has to be remembered that conservancy systems in India have hitherto been defective in several respects, and have undoubtedly in the past assisted in spreading cholera, largely through the contamination of food by the agency of flies which act as transferring agents of the specific organisms of the malady from the open latrines to milk, fruit, and other articles of food exposed for sale to the pilgrims and other persons.

The provincial Governments of India, as has been said, have of late been taking important steps to deal with these and other dangers; and at nearly all the greater festivals, and at most of the frequented shrines, special precautions are observed so as to meet the risks arising from the presence of human cholera carriers, and more particularly to prevent the excremental pollution of water supplies, bathing places, and surface soil, as well as to avoid the contamination of food by flies.

The following table shows the recorded incidence of fatal cholera in the British districts of India during the last 22 years :—

Deaths recorded from Cholera in the British Districts of India
1896 *to* 1917.

Year.	Cholera Deaths.	Cholera Death-rate per 1,000 of the Population.
1896	471,779	2·17
1897	555,035	2·55
1898	152,711	0·70
1899	171,410	0·78
1900	797,222	3·70
1901	271,210	1·21
1902	224,136	0·99
1903	312,854	1·38
1904	192,835	0·85
1905	441,786	1·96
1906	690,519	3·05
1907	408,102	1·81
1908	591,725	2·61
1909	239,231	1·06
1910	430,451	1·90
1911	354,005	1·48
1912	407,769	1·71
1913	294,815	1·24
1914	280,730	1·18
1915	404,472	1·70
1916	288,047	1·21
1917	267,002	1·12
Total in 22 years	8,247,846	—

It has to be borne in mind that the above figures are incomplete, and represent only those areas of India which are under registration. The numbers of fatal cholera cases that occurred in the Native States are not given in detail in the official publications available for reference at the time of writing.

As regards the seasonal incidence of cholera in India, the number of fatal cases recorded, month by month, in the seven years 1909 to 1917, in the British districts of India, is shown in the next table.

Deaths from Cholera in the British Districts of India, recorded, month by month, from 1909 *to* 1917.*

Months.	1909.	1910.	1911.	1912.	1913.	1914.	1915.	1916.	1917.
Jan. -	11,720	13,851	21,288	27,822	21,155	16,598	18,572	18,900	8,989
Feb. -	8,437	9,325	11,674	15,053	11,683	14,720	12,660	10,573	6,716
Mar. -	18,414	13,252	11,373	22,047	13,248	25,996	23,082	14,910	11,467
April -	33,160	25,518	21,446	36,194	24,984	27,331	30,913	21,377	18,312
May -	30,185	33,392	23,791	54,219	39,205	21,994	26,545	46,530	25,526
June -	23,282	33,405	38,797	53,282	37,344	22,890	25,560	24,474	35,291
July -	20,723	74,703	78,310	41,240	38,078	20,440	22,598	24,942	23,615
Aug. -	19,612	67,454	44,561	51,320	31,147	27,869	32,440	51,468	20,566
Sept. -	15,533	32,590	17,389	41,299	21,291	27,355	33,385	22,238	20,026
Oct. -	18,436	46,704	24,290	20,585	16,452	20,772	65,005	17,261	33,987
Nov. -	21,741	45,563	32,131	17,865	16,061	25,511	68,817	19,469	32,958
Dec. -	17,988	34,694	28,955	26,843	24,167	29,254	44,895	15,905	29,549
Total	239,231	430,451	354,005	407,769	294,815	280,730	404,472	288,047	267,002

These British districts in which the above cholera deaths were reported had at the 1911 census a combined population of 243,826,671.

Bengal.

The deaths from cholera in Bengal during 1914 amounted to 89,224, as compared with 78,898 in 1913, giving a cholera mortality-rate for the former year of 1·95 per 1,000 of the population and 1·74 for the latter, the mean of the past five years being 1·98. The average number of cholera deaths recorded in the previous five years, 1909 to 1913, was 90,031, so that 1914 may be regarded as being only an average year as regards cholera mortality. There was the usual seasonal incidence at the beginning of the cold weather, with a second wave during March and April. The following table gives, month by month, the number of deaths from cholera recorded in Bengal during 1914 :—

1914.	Cholera Deaths.
January - - - - - -	7,801
February - - - - - -	7,798
March - - - - - - -	18,600
April - - - - - - -	16,469
May - - - - - - -	6,500
June - - - - - - -	2,048
July - - - - - - -	952
August - - - - - - -	1,027
September - - - - - -	1,080

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* Abstracted from the Annual Reports of the Sanitary Commissioner with the Government of India.

1914.	Cholera Deaths.
October	2,558
November	10,015
December	14,376
Total for 1914	89,224

Of these deaths, 47,738 were males and 41,486 females. Out of 487 registering circles in the province only 18 were quite free from cholera during the year. The districts which had the highest number of cholera deaths were Dacca, 24-Pargannas, and Nadia, as can be seen in the appended table :—

District.	Population in 1911.	Cholera Deaths in 1914.	Cholera Death-rate per 1,000 of the Population.
			Per cent.
Dacca	2,960,402	8,568	2·89
24-Pargannas	2,434,104	6,954	2·86
Nadia	1,617,846	6,772	4·19

The prevalence of cholera in the Dacca district is associated with the want of good drinking water, the rural supplies at certain seasons being very scanty.

Among the towns which suffered from cholera during the year, Nadia (population 12,480) may be mentioned, its cholera mortality-rate being as high as 12·90 per 1,000 living. The outbreak at Nadia was due to a large influx of pilgrims during the *San* festival in February, during which month alone 142 persons died from the disease in this town.

The Sanitary Commissioner, in his Annual Report for 1914, mentions a prevalence of cholera in the district of Birbhum, where 2,687 deaths occurred. The appearance of the disease followed upon a time of scarcity, due to the high prices of the ordinary food used by the natives, causing them to eke out their scanty rations with unsuitable and unwholesome jungle products, which impaired their powers of resistance and made them more susceptible to the reception of the cholera infection. The disease was introduced by returning pilgrims from Nabadip, in the Nadia district; and these persons spread the infection wherever they went, the villagers themselves also doing the same by moving about from place to place, taking no precautions whatsoever. In Birbhum district in the month of February, 241, and in March, 1,556, persons died of cholera; in April the number fell to 508, and in May the disease subsided. Wells as sources of water supply are not much in vogue in this province, but where such supplies were in use in cholera-affected villages, they were disinfected by means of permanganate of potash, the civil surgeons in the districts of Dacca and Birbhum reporting that the results were beneficial.*

There was a notable increase in the amount of cholera recorded in Bengal during 1915, the number of deaths being 130,679, or 41,455 more than in the previous year. Although the disease was prevalent throughout the whole year there were apparently, as in the previous year, two epidemics, one in March and April and the other in October, November, and December.

The fatal incidence of cholera in the province during 1915 is shown, month by month, in the appended table:—

1915.	Cholera Deaths.
January	7,496
February	5,447
March	16,110
April	19,833
May	8,983
June	4,840
July	4,786
August	5,108
September	6,645
October	12,823
November	19,681
December	18,927
Total	130,679

The Dacca Division was the worst sufferer during 1915; no fewer than 52,452 deaths from cholera were recorded in it, and of these, 26,662 occurred in the Mymensingh district, giving a death-rate of 5·89 per 1,000 of the population. The increased incidence of the disease in the Dacca Division was said to have been associated with inadequate water supplies, which became more scanty in the rural areas in the dry season, and being subject to gross contaminations. When floods occur the water supplies are liable to pollutions carried from a distance. In some cases, during an epidemic, dead bodies are thrown into the rivers, and add to the contamination. In some towns provided with a piped water supply, some of the inhabitants prefer to drink the polluted river water, and it is among such persons that cholera chiefly occurs.†

During 1916 the number of deaths from cholera in Bengal fell to 70,836, the lowest on record since the reconstitution of the Presidency in 1912. The cholera mortality-rate was 1·56 per 1,000 of the population, against 2·88 in 1915 and 1·95 in 1914.

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* Report on Sanitation in Bengal for the Year 1914, by Major W. Wesley Clemesha, I.M.S., Sanitary Commissioner.

† Sanitation in Bengal for the Year 1915, by Dr. C. A. Bentley, Sanitary Commissioner.

The largest number of deaths was reported in the Presidency Division, namely, 25,255, and of these, 9,394 were referred to the 24-Pargannas district. In the Dacca Division, 16,878 fatal cases of cholera occurred, and of these, 7,412 were recorded in the Mymensingh district that suffered so much in the previous year. The course of the 1916 cholera prevalence is shown in the next table, the largest number of deaths occurring in the month of April :—

1916.	Cholera Deaths.
January	10,064
February	6,144
March	10,969
April	12,168
May	8,039
June	3,212
July	2,693
August	1,868
September	927
October	1,490
November	4,599
December	8,663
Total in 1916	70,836

Of these deaths, 37,936 were males and 32,900 females.

Wells as sources of domestic water supply are little appreciated in many parts of Bengal, preference being given to tanks and rivers. But where wells were the source of supply, they were disinfected by permanganate of potash with beneficial results. Cholera continued to be prevalent in Bengal during 1917, but in less amount than in any of the previous five years, 45,021 deaths from the disease being recorded, as compared with 70,836 in 1916 and 130,679 in 1915. The death-rate for cholera in 1917 was 0·99 per 1,000, against a mean rate of 2·05 for the previous five years. The Sanitary Commissioner† attributes the reduced cholera mortality of 1917, in some degree, to the increased rainfall, and especially to the heavy falls of rain during June and October, these rains being of great value in diminishing the prevalence of cholera. The district which suffered most was Howrah, the cholera death-rate there being 3·32 per 1,000, Hooghly and Midnapore coming next with rates of 2·14 and 2·11 respectively. Tanks and streams, which form the chief sources of water supply in the rural areas, are all liable to be contamined by human excreta ; so long as this is not prevented, outbreaks of cholera will occur from year to year, especially during the dry months, when the available supply of water is often very limited. The following

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[*] Report on Sanitation for the Year 1917 in Bengal, by Dr. C. A. Bentley, Sanitary Commissioner.

table gives the seasonal incidence of cholera in Bengal during 1917:—

1917.	Cholera Deaths.
January	5,221
February	2,984
March	4,707
April	6,514
May	3,351
June	1,204
July	1,048
August	967
September	1,229
October	2,952
November	4,888
December	9,956
Total in 1917	45,021

Of these fatal cases, 23,898 were males and 21,123 females. No outbreak of cholera was reported in any of the fairs during the year, except during the Rash Jatra fair at Santipur in November, and at the Chait Sunkrati fair at Tarakeswar in April, at both of which cases of cholera occurred; but the mortality was small, the deaths numbering only 10, although over 25,000 persons assembled at each of these two gatherings. All necessary sanitary and medical precautions at all big fairs and festivals are now taken by the authorities.

Bengal, as now constituted differs much from the old province, its boundaries having been greatly altered at the end of 1911. Comparison, therefore, of the incidence of cholera in past and present years is scarcely justifiable; but since the new administrative area was set up the figures are as follows:—

Year.	Cholera Deaths.	Cholera Death-rate per 1,000 of the Population.
1912	95,467	2·10
1913	78,898	1·74
1914	89,224	1·95
1915	130,679	2·88
1916	70,836	1·56
1917	45,021	0·99
Total in six years	510,125	—

Excluding the Chittagong Hill tracts, to which the system of registration of vital statistics has not yet been introduced, the population of the Bengal Presidency in 1912 amounted to 45,329,247.

Up to the end of June, 1918, 24,367 deaths from cholera had been reported in Bengal.

Calcutta (population (1912) 896,067).—There were 1,983 deaths from cholera in the City of Calcutta during 1914, as against 1,764 in 1913 and 2,244 in 1912, the death-rate from this disease in 1914 being 2·21 per 1,000 of the population; the mean rate for the previous five years period was 2·18. The distribution of these cholera deaths throughout the months of 1914 is given in the tabular statement below :—

1914.	Cholera Deaths.
January	143
February	323
March	430
April	485
May	297
June	42
July	20
August	23
September	46
October	26
November	60
December	88
Total	1,983

Of these fatal cases, 1,321 were males and 662 females.

As in previous years, the riparian wards of the city suffered most, and this fact, along with the heavy incidence of cholera among the Hindus, are evidences of its water-borne origin in Calcutta. The Medical Officer of Health in his Annual Report* draws attention to the existence of " thousands of service privies, often in close proximity to sweet-shops, cow-houses, &c.," which must aid in the dissemination of the disease by flies.

During 1915, cholera caused 1,612 deaths in Calcutta as compared with 1,983 in the previous year—that is, 371 fewer fatal cases than in 1914; this is the smallest number of cholera deaths registered in this city during the last 16 years (*see* table below). The annual epidemic began later than that of the preceding year, which lasted four months, and was practically confined to March and April.

The next table gives the number of cholera deaths registered in Calcutta in each month of 1915 :—

1915.	Cholera Deaths.
January	61
February	91

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* Annual Report of the Health Officer of Calcutta for the Year 1914, by Dr. H. M. Crake.

1915.	Cholera Deaths.
March	455
April	396
May	120
June	54
July	74
August	67
September	68
October	61
November	79
December	86
Total in 1915	1,612

Dr. Crake, in his Annual Report for 1915, says that "washing out the mouth whilst bathing and the cleansing of kitchen utensils while bathing are probably the commonest means of spreading cholera in Calcutta. Salads and vegetables require very thorough cleansing if they are to be eaten raw."

During 1916 there was a further decrease in the number of deaths reported from cholera in Calcutta, the total fatal cases for the year being 1,335. A gradual diminution in cholera mortality in this city has been observed for the past 10 years. In 1907 the deaths from this disease numbered 3,803, so that the decrease in 1916 was very marked, notwithstanding the well-recognised fact that cholera is endemic in Calcutta. The prevalence of the malady in 1916 followed the usual course; it began towards the end of the cold season and reached its height early in the hot season. The number of cholera deaths registered in the city, month by month, during 1916 is shown in the following table :—

1916.	Cholera Deaths.
January	67
February	51
March	201
April	399
May	204
June	141
July	42
August	45
September	28
October	21
November	42
December	94
Total in 1916	1,335

As has been said, a good deal of the cholera in Calcutta is water-borne; though contamination by flies, or by dust, of food exposed for sale cannot be ignored.

Cholera continued to be present in Calcutta during 1917, but only 866 deaths from it were reported, compared with 1,335 in the previous year and 1,612 in 1915. This being the lowest number of fatal cholera cases ever recorded in this city in any other year. The distribution of these 866 deaths is shown below :—

1917.	Cholera Deaths.
January	57
February	56
March	71
April	177
May	181
June	81
July	26
August	30
September	49
October	57
November	41
December	40
Total in 1917	866

During the first half of 1918, 860 fatal cases of cholera were registered in Calcutta, of which 26 occurred in January, 37 in February, 259 in March, 294 in April, 194 in May, and 50 in June.

The subjoined table gives the fatal incidence of cholera in Calcutta, year by year, for the past 18 years, *i.e.*, from 1900 to 1917 inclusive :—

Year.	Cholera Deaths.
1900	2,754
1901	1,720
1902	2,716
1903	1,990
1904	2,056
1905	2,323
1906	2,504
1907	3,803
1908	3,694
1909	2,022
1910	1,901
1911	1,860
1912	2,244
1913	1,764

Year.	Cholera Deaths.
1914	1,983
1915	1,612
1916	1,335
1917	877
Total in 18 years	39,158

The Port of Calcutta.—Among the Asiatic floating population (estimated at 25,843) in the port of Calcutta, 66 deaths were reported from cholera during 1914, against 70 in 1913. Two native firemen were removed from ocean-going vessels and taken to hospital for isolation and treatment. Altogether 78 cases among the natives employed on boats and larger vessels in the river were removed to hospital suffering from cholera, and, so far as can be learned, no European seamen suffering from the disease were admitted to hospital during 1914.

The police returns show that 127 human corpses and 328 carcasses of animals were found floating in the River Hooghly and sunk within the port limits. The latrines in the vicinity of the docks were occasionally found, on inspection, to be in a bad condition.*

During 1915, 57 cases of cholera and 51 deaths were recorded among the Asiatic floating population of Calcutta port. Only one case of cholera was removed from sea-going vessels during the year. The bathing and burning *ghats* of the port were kept in good order. Occasionally some of the latrines were again found in bad condition. The foreshores of the river were, on the whole, kept fairly clean.† The police returns show that 85 corpses and 471 carcasses were found floating in the river within the limits of the port during 1915.

During 1916, 54 cases and 45 deaths from cholera were reported in Calcutta port; 13 of the cases of cholera occurred on board sea-going vessels. Complaints were still made regarding the state of the latrines on the banks of the Hooghly. The police report that 91 human corpses were found floating in the river as well as 1,216 carcasses of animals, during the year, as compared with 85 human corpses and 471 animal carcasses in the previous year.

In 1917, 28 deaths from cholera were recorded in the Asiatic floating population in the port of Calcutta. Two cholera cases were discovered on the ocean-going vessel "Arankola." All the usual precautions were taken, and no further cases occurred. The Deputy Commissioner of the Port Police reported that during 1917, 114 corpses were found floating in the River Hooghly, against 91 in the previous year; and 1,218 carcasses of animals found in the river were also suitably dealt with, as compared with 1,216 in 1916.

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* Annual Report of the Health Officer for the Port of Calcutta for the Year 1914, by Dr. W. C. Hossack.

† The Annual Report of the Port Health Officer for 1915.

The *Port of Chittagong*, 220 miles east of Calcutta, on the eastern side of the Bay of Bengal, had in 1911 a population of 25,000. In 1915 a fatal case of cholera in the person of a young English sailor occurred during July on board the s.s. "Heligoland," after she had been 11 days in the port of Chittagong. Also, during the same month, an Arab stoker of the s.s. "Clive" died of cholera two days after reaching Chittagong. The infection in both instances was attributed to the drinking of contaminated and unboiled milk, along with the ingestion of green fruits, sold on the wharves by itinerant vendors, and which had been exposed for some time to dust and flies.*

So far as can be ascertained no cases or deaths from cholera occurred at Chittagong port during 1916 or 1917.

Bihar and Orissa.

There were 32,115 deaths from cholera in Bihar and Orissa during 1914, giving a death-rate from the disease of 0·9 per 1,000 of the population. In the previous year the deaths from cholera numbered 71,379, giving a death-rate of 2·05. The incidence of fatal cholera in 1914, month by month, is shown in the appended table :—

1914.	Cholera Deaths.
January	719
February	1,262
March	2,047
April	3,449
May	4,648
June	4,140
July	2,098
August	1,995
September	2,757
October	3,617
November	3,340
December	2,043
Total	32,115

As regards the sex distribution, 16,204 deaths were referred to males and 15,911 to females.

The districts which had the largest number of cholera deaths in 1914 were Cuttack and Puri, in the Orissa Division,

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* Annual Report of the Health Officer for the Port of Chittagong for 1915.

Darbhanga in the Tirhut Division, and Gaya and Patna in the Patna Division :—

District.	Population in 1911.	Cholera Deaths.	Cholera Death-rate per 1,000 of the Population.
Cuttack - -	2,109,139	6,486	3·1
Puri - - -	1,023,402	2,525	2·5
Darbhanga -	2,929,682	4,779	1·6
Gaya - - -	2,161,010	2,856	1·3
Patna - -	1,609,631	2,224	1·4

The epidemic in the Cuttack district began in September, the infection, it is believed, having been imported by pilgrims returning from the Rath Jatra at Puri, one of the most sacred places in India, and situated on the coast of Orissa. It owes its reputation to a temple erected in honour of Vishnu, and thousands of pilgrims flock annually to the town to take part in the numerous religious festivals of which the Rath Jatra is one. The evidence collected shows that Puri is a centre from which cholera is continually being disseminated by pilgrims. As regards preventive measures, some of the village authorities have been supplied through the agency of the police, and others through postmasters and district educational officers by payment, with permanganate of potash for the purpose of disinfecting wells. The system seems to be gradually growing in popularity with the natives.*

During 1915 cholera continued to be prevalent in Bihar and Orissa, more especially in the late summer and autumn months, as will be seen in the following table, causing 88,349 deaths.

1915.	Cholera Deaths.
January - - - - - -	1,450
February - - - - - -	1,542
March - - - - - - -	2,649
April - - - - - - -	3,853
May - - - - - - -	4,521
June - - - - - - -	5,024
July - - - - - - -	7,287
August - - - - - - -	12,239
September - - - - - -	9,765
October - - - - - -	15,205
November - - - - - -	17,615
December - - - - - -	7,199
Total - - - - -	88,349

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* Annual Sanitary Report of Bihar and Orissa for the Year 1914, by Lieut.-Col. E. C. Hare, I.M.S., Sanitary Commissioner.

The sex distribution of these deaths was 44,857 males and 43,492 females. The cholera death-rate for the province was 2·5 per 1,000 of the population, against a mean rate of 2·2 for the previous five years. The largest number of fatal cases occurred in the district of Darbhanga, in which 11,637 were recorded, 10,601 in Cuttack, and 10,229 in Shahabad: the respective cholera mortality-rates in these districts being 3·9 5·0, and 5·4. In some places epidemic cholera was an after effect of floods. District Boards distributed "cholera pills," along with leaflets giving advice: and permanganate of potash was given gratuitously during epidemic times for the purpose of disinfecting wells.*

In 1916 cholera caused 90,582 deaths in Bihar and Orissa, giving a death-rate of 2·6 per 1,000 of the population.

The largest number of these deaths occurred in the Tirhut Division, in which 41,626 fatal cases were recorded, of which 23,317 were referred to the district of Muzaffarpur, the cholera death-rate of this district for 1916 being 8·1 per 1,000 living. Of the total 90,582 cholera deaths, 46,359 were males and 44,223 females. The epidemic of 1916 reached its height in the month of May, in which 25,832 deaths were reported. The course of the prevalence during the year is shown in the subjoined table which gives the number of fatal cases recorded month by month:—

1916.	Cholera Deaths.
January	2,152
February	1,078
March	765
April	2,628
May	25,832
June	12,853
July	6,556
August	13,275
September	5,908
October	6,689
November	9,823
December	3,023
Total	90,582

Some of the outbreaks of cholera in this province during 1916 were associated with excessive rainfall and floods. Disinfection of wells by means of potassium permanganate was continued, but owing to the great increase in the price of this, quick lime was substituted as a temporary measure.†

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* Annual Sanitary Report of the Province of Bihar and Orissa for 1915, by Major W. C. Ross, I.M.S., Officiating Sanitary Commissioner.

† Annual Sanitary Report of the Province of Bihar and Orissa for the Year 1916, by Major W. C. Ross, Officiating Sanitary Commissioner

In 1917 cholera continued to appear in this province, the annual epidemic attaining its maximum in June, when 25,628 fatal cases were reported. The total cholera mortality in this province during 1917 was 109,620, which is the highest number yet registered in any year since Bihar and Orissa was constituted a province in 1912.

The seasonal incidence of fatal cholera in Bihar and Orissa during 1917 is shown in the next table :—

1917.	Cholera Deaths.
January	1,103
February	616
March	1,522
April	3,888
May	12,997
June	25,628
July	13,735
August	11,849
September	9,230
October	15,332
November	10,466
December	3,254
Total	109,620

Of these 109,620 cholera deaths, 55,803 were males and 53,817 females. The death-rate from this disease during 1917 was 3·1, against 2·8, the mean of the previous 10 years. The districts which suffered most were Patna, with a cholera mortality-rate of 7·4 per 1,000 living, Gaya, 6·3, Muzaffarpur, 6·6, and Champaran, 8·1. The disease was present in a mild form in some parts of the province during the year. The climatic conditions appear to have been favourable for the spread of cholera in 1917. In previous years it has been customary to use potassium permanganate for the disinfection of wells liable to spread cholera. Owing to the war the cost of this preparation rose considerably, and the Sanitary Commissioner advised the substitution of quick lime, as in 1916. Chlorogen has been used extensively by some of the municipalities.*

As the new Province of Bihar and Orissa was constituted in 1912, the summary of cholera deaths in it cannot here be given for the years previous to that time; but the next table gives the number of fatal cases recorded during the six years' period 1912 to 1917 inclusive :—

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* Annual Sanitary Report of the Province of Bihar and Orissa for the Year 1917, by Major W. C. Ross, I.M.S., Sanitary Commissioner.

Cholera Deaths in Bihar and Orissa 1912 *to* 1917.

Year.	Cholera Deaths.	Cholera Death-rate per 1,000 living.
1912	77,289	2·2
1913	71,080	2·0
1914	32,115	0·9
1915	88,349	2·5
1916	90,582	2·6
1917	109,620	3·1
Total in six years	469,035	2·2

The population of the area forming this province at the census of 1911 was 38,435,293, of which 3,945,209 were living in Native States included in Bihar and Orissa.

The Presidency of Madras.

There were 68,449 deaths recorded from cholera in the Presidency of Madras during 1914, as compared with 37,730 in the preceding year. The cholera death-rate per 1,000 living was 1·7, against 0·9 in 1913, and a mean of 1·3 for the previous five years. Of the total 44,056 towns and villages comprised in the Presidency, cholera invaded 7,590 in 1914, compared with 4,892 in 1913. The height of the prevalence was reached during the months of July, August, and September, as may be seen in the following tabular statement :—

1914.	Cholera Deaths.
January	6,780
February	3,921
March	1,916
April	2,090
May	2,042
June	4,897
July	9,257
August	10,490
September	8,493
October	5,647
November	5,070
December	7,846
Total	68,449

There were more deaths from cholera among males than among females, the numbers being respectively 35,933 and 32,516. The disease was prevalent in all the 25 districts of the Presidency, with one exception, the Nilgiris. The three districts which showed the highest number of cholera deaths were the following :—

District.	Population in 1911.	Cholera Deaths in 1914.	Cholera Death-rate per 1,000 of the Population.
Tanjore - -	2,361,582	8,925	3·8
South Arcot -	2,361,741	5,345	2·3
Kurnool - -	935,116	5,262	5·6

Tanjore district, in 1913, headed the list with the largest number of fatal cases of cholera.

For the purification of contaminated water supplies, permanganate of potash was largely employed, and from the reports of those who supervised its use it appears that good results were obtained.*

During 1915 there was a considerable reduction in the amount of fatal cholera recorded in the Madras Presidency, the fatal cases numbering 30,098, as compared with 68,449 in the previous year. These deaths were distributed throughout the months of 1915 as follows :—

1915.	Cholera Deaths.
January - - - - - -	8,600
February - - - - - -	4,840
March - - - - - - -	2,743
April - - - - - - -	2,511
May - - - - - - -	1,494
June - - - - - - -	1,288
July - - - - - - -	1,882
August - - - - - - -	1,698
September - - - - - -	1,068
October - - - - - -	727
November - - - - - -	821
December - - - - - -	2,426
Total - - - - -	30,098

Of these deaths, 16,232 were referred to males and 13,866 to females. The cholera death-rate for 1915 was 0·8 per 1,000 of the population, against a mean rate of 1·4 for the last five years. The districts which suffered most were Tanjore (which also headed the list in 1913 and 1914) with 4,627 deaths, South Arcot with 3,137, Trichinopoly with 2,971, Tinnevelly with

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* Annual Report of the Acting Sanitary Commissioner with the Government of Madras for the Year 1914, by Lieut.-Col. H. Thompson, I.M.S.

2,840, Madura with 2,763, and Salem with 2,270. The disease appeared in all of the 25 districts of the Presidency. Of the 44,056 towns and villages in the province, 4,283 were invaded by cholera in 1915. As will be seen in the table above the greatest incidence of the disease was in the two first months of the year. The same measures as in the previous year were carried out to control cholera in the Presidency, including the purifying of contaminated water supplies by permanganate of potash. The mortality from the disease in municipalities which possess a piped water service has been continuously on the decrease since these supplies were introduced.*

There was a further decline in cholera mortality in the Presidency during 1916, the deaths amounting to 16,735, giving a cholera death-rate of 0·4 per 1,000 of the population. All districts registered fatal cases of the disease, except the Nilgiris. The district of Ganjam had the largest number of cholera deaths, namely, 2,476, equal to a mortality-rate of 1·3 per 1,000. The disease was present during the year and caused deaths in 2,640 towns and villages, compared with 4,283 in 1915. The cholera mortality was heaviest in the months of January to April, and again in November and December. The following table gives the cholera deaths registered month by month during 1916 in the Madras Presidency :—

1916.	Cholera Deaths.
January	4,112
February	2,362
March	1,761
April	1,166
May	304
June	574
July	776
August	937
September	860
October	636
November	1,260
December	1,987
Total	16,735

The sex distribution of these deaths from cholera was 8,813 males and 7,922 females. The Sanitary Commissioner attributes the decrease of fatal cholera, observed in recent years, to "a better knowledge on the part of the public of the accepted preventive measures for combating it and active participation in checking its spread."†

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* The Annual Report of the Sanitary Commissioner for the Madras Presidency for the Year 1915, by Major W. A. Justice, I.M.S.

† The Annual Report of the Sanitary Commissioner for the Madras Presidency for the Year 1916, by Major W. A. Justice, I.M.S.

Cholera was again present in the Madras Presidency during 1917, the deaths from the disease amounting to 58,939, giving a death-rate of 1·5 per 1,000 of the population, the mean rate of the previous five years having been 1·2. The distribution of these fatal cases over the year is seen in the subjoined table:—

1917.	Cholera Deaths.
January	1,532
February	1,088
March	1,045
April	1,953
May	2,638
June	2,950
July	5,465
August	4,706
September	4,073
October	7,951
November	11,054
December	14,484
Total	58,939

Of these fatal cases, 30,785 were males and 28,154 females. The disease was present in every district of the Presidency. Kistna and Godaveri had the highest death-rates from cholera, namely, 4·2 and 4·0 respectively. Anantapur had a rate of 3·1 and Bellary 3·0. As seen in the table above, the cholera mortality was highest from July to December. Among the towns, Palni, with a population of 13,211, suffered most, its cholera death-rate being as high as 13·9 per 1,000. Of 44,056 towns and villages in the Presidency, deaths from cholera were reported in 5,191, against 2,640 in the previous year. Recognising the need of providing protected water supplies for the villages as part of the campaign against cholera, efforts have been made to introduce pumps for the wells; but this has met with but small success, owing to their liability to get out of repair.* Since the introduction of the piped water supplies to towns, cholera mortality has been continuously decreasing.

The prevalence of cholera in the Presidency continued during the first half of 1918, some 54,987 cases and 32,091 deaths being recorded.

The *City of Madras* is seldom free from cholera, the usual explanation being that the infection is brought into the municipal area from the villages in the surrounding district, where the disease is said to be endemic. During 1914 there were 2,332 cases reported in the city, and of these, 1,757, or 75·3 per cent., terminated fatally. The prevalence began to increase towards the end of July and continued till November, as will be seen in the following table :—

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* Annual Report for 1917 of the Sanitary Commissioner with the Government of Madras, by Major W. A. Justice, I.M.S.

Cholera in the City of Madras in 1914.

1914.	Cholera Deaths.
January	5
February	1
March	1
April	—
May	4
June	20
July	60
August	157
September	551
October	780
November	166
December	12
Total	1,757

The cholera death-rate in this city for 1914 was 0·3 per 1,000, the mean of the four previous years having been 0·6. The usual cholera season in Madras is from July to September, but the considerable increase in October 1914 was said to be due to the following circumstance :—The raiding German cruiser "Emden" paid a flying visit to the port of Madras on 23rd September. This caused considerable alarm, especially among the poorer classes, who fled from the city into the surrounding district. This great exodus of people into villages unprepared for such visitors caused a shortage of food supplies and great increase in prices, so that many of the people had to return to the city or starve. During their stay in the country district some of them acquired cholera and brought it back with them to the city.*

There were only 63 cases and 35 deaths from cholera in the city of Madras during 1915; the death-rate from this disease was 0·07 of the population, as compared with the mean rate of 1·2 for the previous five years.

In 1916 cholera declined still further in Madras city, only 48 cases and 30 deaths being recorded, seven of the cases being imported; 24 of the deaths occurred during the months of January and February.

During 1917, 130 cholera cases, with 76 deaths, were recorded, the majority of them in the months of July and August. In the first six months of 1918 there were 76 reported cases and 43 deaths from cholera in Madras city.

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* Annual Report of the Health Officer of the Corporation of Madras for 1914, by Dr. W. R. Macdonald.

The incidence of cholera in the Madras Presidency during the last 23 years is shown the appended table :—

Year.	Cholera Deaths.	Cholera Death-rate per 1,000 Population.
1895	21,172	0·6
1896	47,847	1·3
1897	143,445	4·4
1898	65,444	2·0
1899	29,082	0·9
1900	60,662	1·8
1901	81,370	2·2
1902	29,796	0·8
1903	27,393	0·7
1904	23,109	0·6
1905	16,888	0·5
1906	142,811	3·9
1907	81,565	2·2
1908	141,970	3·9
1909	39,424	1·1
1910	32,594	0·9
1911	58,174	1·4
1912	92,497	2·3
1913	37,730	0·9
1914	68,449	1·7
1915	30,098	0·8
1916	16,735	0·4
1917	58,939	1·5
Total in 23 years	1,347,194	—

The population of the Madras Presidency at the 1911 census was 46,217,245 (including Native States).

The Presidency of Bombay.

During 1914 the deaths reported from cholera in the Bombay Presidency amounted to 17,779, against 5,134 in the previous year. Cholera deaths were recorded in 20 out of the 27 collectorates into which this province is divided, but the disease was epidemic in only 12 of them, those chiefly affected being Satara, Poona, Ahmednagar, Sholapur (all four being in the Central Registration District), and Nasik (in the Western Registration

District). The number of cholera deaths in each of these five collectorates is shown in tabular form below :—

Collectorate.	Population in 1911.	Cholera Deaths in 1914.	Cholera Death-rate per 1,000 of the Population.
Satara - - -	1,080,798	3,730	3·45
Poona - - -	1,064,806	2,873	2·70
Ahmednagar - -	943,996	2,785	2·95
Sholapur - - -	768,017	1,804	2·35
Nasik - - -	903,644	1,217	1·35

Thus these five collectorates contributed between them 12,409 deaths, or 70 per cent. of the total for the year.

The cholera death-rate for the Presidency in 1914 was 0·91, the mean rate for the previous five years having been 1·12 per 1,000 of the population.

The distribution of the fatal cases throughout the year is given, month by month, in the subjoined table :—

1914.	Cholera Deaths.
January - - - - - -	80
February - - - - - -	116
March - - - - - - -	236
April - - - - - - -	1,109
May - - - - - - -	3,493
June - - - - - - -	4,183
July - - - - - - -	3,189
August - - - - - - -	2,853
September - - - - - -	1,278
October - - - - - -	740
November - - - - - -	397
December - - - - - -	105
Total - - - - -	17,779

Of these deaths, 8,950 were males and 8,829 females.

According to the weekly statement received from India as to cholera attacks, there were altogether 31,474 cases reported during the year. Calculated on the above returns the case mortality-rate was 56·5 per cent.

On several occasions during 1914 pilgrimages and religious fairs were instrumental in the spread of the disease in this Presidency. The assembling of pilgrims at Pandharpur was an instance in which cholera was diffused after their dispersal to their homes. Pandharpur has a celebrated temple dedicated to one of the incarnations of Vishnu. This place is regarded as sacred, and annual fairs are held, at which as many as

200,000 pilgrims may attend. The Sanitary Commissioner, in his Annual Report,* remarks that there was no doubt that a great deal of cholera was caused by the pilgrims on their return from Ashadi fair. In the city of Poona, with a population of 859,267, a cholera outbreak was caused by specific contamination of the public water supply, which is derived from Lake Fife. It appears from a report supplied by Captain Morison, I.M.S., that a cholera outbreak had previously occurred in a village situated on the banks of one of the feeders of this lake; following upon heavy rains, infected material was washed into the stream and reached the public water supply. Some 2.373 deaths resulted from the epidemic in Poona city, giving a cholera death-rate of 2·76 per 1,000 of the population. The Sanitary Commissioner states that the history of cholera during the year emphasises the danger underlying the movements of the population; if the disease breaks out among the pilgrims attending the spring fair at Pandharpur, the infection is carried throughout the Deccan and Southern Maharatta country. In the prevention of cholera the proper control of the pilgrim centres will do much to prevent the spread of the infection; but the suppression of the disease must depend to a great extent upon the prevention of the excremental pollution of water, food, and soil.

There was a considerable drop in the number of deaths from cholera reported in the Bombay Presidency during 1915, only 377 being registered, as compared with 17,779 in the preceding year.

The seasonal distribution of the cholera deaths during 1915 in the Bombay Presidency is shown in the subjoined table :—

1915.	Cholera Deaths.
January	10
February	18
March	16
April	25
May	42
June	19
July	31
August	79
September	73
October	17
November	1
December	46
Total	377

Only once in the last 50 years, states the Sanitary Commissioner, has this Presidency been so fortunate as regards escaping almost entirely from the ravages of cholera ; though the comparative freedom of 1915 cannot be taken as an index of sanitary progress, for the main cause of cholera in the province, the indiscriminate fouling of the soil, continues with small sign of improvement. This disease is also associated with an excessive incidence of "diarrhœa and dysentery," 31,707 deaths from this cause being registered during 1915, and 42,961 in the previous year. The Sanitary Commissioner also draws attention to the marked advance in the method of saving the lives of those attacked by cholera by the issue of special "treatments," which consist of 24 permanganate of potash pills, made according to Sir Leonard Roger's formula.*

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* Annual Report of the Sanitary Commissioner for the Government of Bombay for 1914, by Major F. H. G. Hutchinson, I.M.S.

During 1916 cholera mortality rose again from 377 in 1915 to 19,841, giving a death-rate for the year of 1·01 per 1,000. All the districts of the Bombay Presidency were affected, with the exception of Kanara, eight of the 20 districts having a cholera death-rate of over 1 per 1,000. The epidemic of 1916 was chiefly felt in the collectorates of East Khandish, with 2,936 (and a cholera mortality-rate of 2·84); West Khandish, 2,531 (4·36); Kaira, 2,391 (3·46); Ahmednagar, 2,009 (2·13); and Nasik (2·21). The epidemic in East Khandish was due to infection brought from the Central Provinces by a railway guard, and subsequently, through the visitors to a fair, the disease was carried to some other districts, and, as other fairs, including Pandharpur, were subsequently involved, a widespread diffusion of the disease resulted. At the end of 1916 cholera was present in the collectorates of Sholapur, Bijapur, and Belgaum. The disease during 1916 followed the lines of human intercourse, and was spread from district to district by pilgrims or other travellers, and water may be said to have played a prominent part in its spread. The course of the annual epidemic is given in the subjoined table :—

1916.	Cholera Deaths.
January	44
February	68
March	284
April	579
May	1,425
June	951
July	4,611
August	5,808
September	2,074
October	1,464
November	998
December	1,535
Total	19,841

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* The Annual Report of the Sanitary Commissioner for the Government of Bombay for 1915, by Major F. H. G Hutchinson, I.M.S.

The prevalence of cholera in the Presidency during 1916 was associated with the monsoon, at which time water supplies receive gross pollutions through the washing of surface impurities by the heavy rainfall into streams and tanks. Disinfection of the wells by permanganate of potash was continued during the year.*

The prevalence of cholera in Bombay Presidency was continued during 1917, the mortality reaching its maximum in March, April and May, in which, respectively, 2,446, 2,877, and 2,002 deaths were recorded from the disease. Though in less amount, fatal cholera cases occurred in each of the other months of the year, as may be seen in the next table, which gives the number of cholera deaths in this province, month by month, during 1917 :—

1917.	Cholera Deaths.
January	808
February	1,653
March	2,446
April	2,877
May	2,002
June	1,697
July	1,480
August	1,148
September	1,198
October	817
November	415
December	402
Total	16,943

The districts that suffered most heavily from cholera during the year were those in the Southern Registration District; of which Belgaum had 5,137 deaths (giving a mortality-rate of 5·45); Dharwar, 4,811 (4·69); and Bijapur, 4,513 (5·23). The infection appears to have been introduced from Pandharpur, and at first it spread slowly until the season for pilgrimages and festivals arrived. These gatherings are associated with general and wide movements of the population. In certain districts cholera spread along the pilgrim routes. The Sanitary Commissioner, in his report,* states that, in the absence of a public health staff, few preventive measures could be taken, but a certain number of wells were disinfected. "Early notification is the essential preliminary of preventive measures."

The incidence of cholera in this Presidency has varied much year by year, as may be seen in the appended table, which gives the number of deaths from the disease recorded in each year from 1892 to 1917, a period of 26 years :—

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* The Annual Report of the Sanitary Commissioner for the Government of Bombay for 1916, by Lieut.-Col. F. H. G. Hutchinson, I.M.S.

Year.	Cholera Deaths.	Cholera Death-rates per 1,000 Popu'ation.
1892 - - -	42,900	—
1893 - - -	18,853	—
1894 - - -	33,588	—
1895 - - -	8,890	—
1896 - - -	35,404	—
1897 - - -	57,108	—
1898 - - -	4,368	—
1899 - - -	8,579	—
1900 - - -	163,889	8·71
1901 - - -	13,600	0·74
1902 - - -	3,229	0·17
1903 - - -	1,825	0·09
1904 - - -	13,156	0·71
1905 - - -	5,396	0·29
1906 - - -	46,119	2·50
1907 - - -	7,656	0·41
1908 - - -	1,759	0·09
1909 - - -	28,714	1·55
1910 - - -	3,817	0·20
1911 - - -	5,817	0·30
1912 - - -	64,505	3·29
1913 - - -	5,134	0·26
1914 - - -	17,779	0·91
1915 - - -	377	0·02
1916 - - -	19,841	1·01
1917 - - -	16,943	0·87
Total in 26 years -	629,246	—

The population of Bombay Presidency at the census of 1911 was 27,084,317, of which 19,672,642 were in the British districts and 7,411,675 in the Native States.

The *City of Bombay* (population, 1911 census, 979,445).—In 1914 there were 334 cases of cholera notified in the city, with 221 deaths, the corresponding figures for the previous year having been 165 attacks and 125 deaths. During 1914, 46 cases were stated to have been imported, and 25 of the cholera deaths occurred among persons newly arrived and not belonging to the city. A number of those attacked were persons who had come from Pandharpur fair. Of the 221 deaths, 133 were males and 88 females; 167 deaths were referred to Hindus, 22 to Native Christians, 20 to Mussulmans, seven to Parsees, two each to Europeans and Jews, and one a Eurasian.*

There was very little cholera in the city of Bombay during 1915, only 29 cases and 16 deaths being reported. Twelve of the cases occurred in March among the troops. The remainder were sporadic, some of them imported from Hardwar and other places frequented by pilgrims. Two of the deaths took place among the floating population in the harbour. The year was noteworthy for the reason that the number of deaths recorded was the smallest since 1848.

During 1916, 208 cases and 141 deaths from cholera were reported, the annual average deaths from this cause for the preceding 10 years, 1906 to 1915, being 488. Of the 208 reported cases, 77 were imported instances.

There was a considerable decrease in the amount of cholera recorded in Bombay city during 1917, 74 cases and 61 deaths being reported; 16 of the cases were imported.

The seasonal distribution of the cholera deaths during the four years 1914, 1915, 1916, and 1917 was as follows :—

Month.	1914.	1915.	1916.	1917.
January - - - -	4	—	1	6
February - - -	—	—	—	—
March - - - - -	4	3	3	1
April - - - - -	7	3	1	—
May - - - - -	7	—	2	1
June - - - - -	26	3	7	1
July - - - - -	45	2	39	8
August - - - -	105	5	43	1
September - - -	17	—	23	7
October - - - -	3	—	5	20
November - - -	1	—	12	7
December - - -	2	—	5	9
Totals - -	221	16	141	61
Cholera death-rate -	0·22	0·01	0·14	0·06

The incidence of cholera in the city of Bombay from 1901 to 1917 inclusive is shown in the subjoined table, which gives for each year the number of recorded cases and deaths, the case mortality-rate per cent., and the cholera mortality-rate per 1,000 living :—

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* Annual Report of the Executive Health Officer for the City of Bombay for the Year 1914, by Dr. J. A. Turner.

Cholera in Bombay City 1901 *to* 1917.

Year.	Cases.	Deaths.	Case Mortality.	Cholera Mortality per 1,000 of the Population.
			Per cent.	
1901 - -	213	198	93·0	0·25
1902 - -	85	75	88·2	0·09
1903 - -	24	17	70·8	0·02
1904 - -	290	219	75·5	0·28
1905 - -	29	26	89·7	0·03
1906 - -	1,484	1,241	83·6	1·26
1907 - -	524	439	83·8	0·43
1908 - -	123	95	77·2	0·09
1909 - -	853	727	85·2	0·74
1910 - -	136	107	78·7	0·10
1911 - -	153	123	80·4	0·12
1912 - -	2,308	1,790	77·6	1·83
1913 - -	165	125	75·7	0·13
1914 - -	334	221	66·1	0·22
1915 - -	29	16	55·1	0·01
1916 - -	208	141	67·8	0·14
1917 - -	74	61	82·4	0·06
Total for 17 years.	7,032	5,621	79·9	

The *Port of Bombay.*—During 1914 nine cases of cholera were reported on board vessels and native craft lying in the harbour, as compared with two such instances in the previous year; and in 1915, 12 cholera cases occurred on vessels, including Asiatic sailing craft, lying in the harbour and docks.

The number of cholera cases reported in the port of Bombay during 1916 was 23, of which 20 occurred on vessels entering the port, and three on vessels, including Asiatic sailing craft, lying in the harbour and docks.

The United Provinces of Agra and Oudh.

There was a marked decrease in the amount of cholera recorded during 1914 in the United Provinces of Agra and Oudh, for there were only 32,498 deaths attributed to this cause, as compared with 60,427 in 1913, a diminution of no fewer than 27,929. The death-rate from cholera in 1914 was 0·69 per 1,000 of the population, the same rate for 1913 having been 1·29, and the mean rate for the past 10 years, 1·49. The prevalence continued throughout the year, the deaths being most numerous in September and October, as will be seen in the subjoined table, which gives the number of cholera deaths in the United Provinces, month by month, during 1914:—

1914.	Cholera Deaths.
January	259
February	266
March	463
April	2,311
May	2,757
June	4,309
July	1,961
August	3,037
September	5,381
October	4,711
November	4,262
December	2,781
Total	32,498

As regards sex, 16,706 of these fatal cases were males and 15,792 females. The largest number of deaths from cholera during the year were reported in the districts of Gorakhpur, Rae Bareli, Partabgarh, and Banda.

District.	Population in 1911.	Number of Cholera Deaths in 1914.	Death-rate per 1,000 of Population.
Gorakhpur	3,201,180	5,227	1·63
Rae Bareli	1,016,864	2,715	2·67
Partabgarh	899,973	2,076	2·31
Banda	657,237	1,957	2·98

Other districts having high death-rates from cholera, as compared with the rate for the whole administrative area, were Fatehpur, Garhwal, and Jhansi.*

The disinfection of wells with permanganate of potash in the invaded villages was carried out, apparently with good results. The provision of piped water supplies to the towns is making progress, as also is the improvement of other sanitary conditions.

Cholera was epidemic in the United Provinces during 1915 and caused no fewer than 90,508 deaths, as compared with 32,498 in the previous year. The main incidence of the disease was observed during the last quarter, as may be seen in the appended table, which gives the number of cholera deaths registered, month by month, during 1915 in the United Provinces :—

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* Annual Report of the Sanitary Commissioner of the United Provinces of Agra and Oudh for 1914, by Lieut.-Col. S. A. Harriss, I.M.S.

1915.	Cholera Deaths.
January	41
February	47
March	427
April	1,901
May	5,053
June	8,916
July	4,003
August	6,101
September	7,583
October	26,615
November	19,821
December	10,000
Total	90,508

From the above it will be observed that nearly 57,000 cholera deaths occurred in the last three months of the year. Of the total deaths from cholera in 1915, 44,753 were males and 45,755 females. The cholera death-rate in the United Provinces for the year 1915 was 1·93 per 1,000 of the population, against a mean rate of 1·41 for the previous five years. The district of Garhwal (with 5.527 deaths) had the highest cholera death-rate, namely, 11·51, Pilibhit (5,458 deaths) being next with a rate of 11·19, and Almora (5,086), 9·68. After the Kumbh fair in Hardwar, the returning pilgrims spread the disease all over the country, setting up foci of the infection. The fair at Hardwar in April was of greater dimensions than usual, being the great 12th yearly Kumbh Mela, and attended by many thousands of pilgrims. In some places bleaching powder was used instead of permanganate of potash to disinfect local wells; but in a number of instances it was found that, owing to native prejudices, the wells had never been disinfected at all. In some cases the permanganating of local water supplies had the immediate effect of driving the villagers to sources of supply usually regarded officially as unfit for use. The Sanitary Commissioner, in his Annual Report,* says that " the villagers would leave permanganated wells untouched, to lap up the water of the filthiest tanks."

Cholera in the United Provinces during 1916 showed a marked decrease, the deaths numbering 33,300, a diminution of 57,208 as compared with 1915. The cholera mortality-rate in 1916 was 0·71 per 1,000, compared with 1·93 in the previous year. The highest death-rates from the disease during 1916 were recorded in Dehra Dun, 2·84; Garhwal, 2·42; and

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* Annual Report of the Sanitary Commissioner of the United Provinces of Agra and Oudh for 1915, by Lieut.-Col S. A. Harriss, I.M.S.

Jalaun, 2·41. The course of the 1916 cholera prevalence is shown, month by month, in the following table :—

1916.	Cholera Deaths.
January	290
February	33
March	227
April	2,990
May	5,745
June	2,975
July	3,487
August	5,759
September	4,593
October	5,277
November	1,810
December	114
Total	33,300

Of these fatal cases, 16,849 were males and 16,451 females. The treatment of contaminated wells by bleaching powder was continued, but experience showed that it loses a considerable part of its available chlorine on storage in tin cases, and the method had to be suspended pending the provision of new arrangements for storing the bleaching powder in glass bottles.

During the early months of 1917, cholera was comparatively infrequent, only 2,343 deaths being reported during the first half of the year; but during the last six months of 1917 the disease became more prevalent and in that period 19,097 fatal cases were recorded, making a total of 21,440 for the year. The seasonal distribution of these deaths is shown in the next table :—

1917.	Cholera Deaths.
January	34
February	36
March	124
April	612
May	384
June	1,153
July	753
August	1,499
September	3,491
October	6,341
November	5,822
December	1,191
Total	21,440

Of these fatal cases, 10,818 were males and 10,622 females. The cholera death-rate for 1917 was 0·46, as compared with 1·0, the mean rate of the previous five years. The district which suffered the most from cholera during 1917 was Gorakpur, in which 7,414 deaths occurred, giving a cholera mortality of 2·32. The district of Partabgurh came next with a rate of 1·87, and Ballia third with 1·73. Difficulty was experienced in getting supplies of permanganate and bleaching powder for disinfecting wells and to this circumstance the excessive mortality in Gorakpur is attributed.*

The behaviour of cholera in the United Provinces in past years can be seen in the appended table, which gives the number of deaths recorded from the disease during the 23 years' period 1895 to 1917, along with the cholera death-rate for each year :—

Year.	Cholera Deaths.	Cholera Death-rate per 1,000 Population.
1895	51,362	1·10
1896	69,147	1·47
1897	44,208	0·94
1898	2,508	0·05
1899	8,142	0·17
1900	84,960	1·81
1901	53,995	1·13
1902	25,160	0·53
1903	47,159	0·99
1904	6,617	0·14
1905	121,790	2·55
1906	149,549	3·14
1907	22,438	0·47
1908	83,544	1·75
1909	21,822	0·46
1910	102,462	2·15
1911	117,689	2·51
1912	18,894	0·40
1913	60,427	1·29
1914	32,498	0·69
1915	90,508	1·93
1916	33,300	0·71
1917	21,440	0·46
Total for 23 years	1,269,619	1·16

The population of the United Province of Agra and Oudh at the census of 1911 was 48,014,080, including 832,036 in the Native States.

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* Annual Report of the Sanitary Commissioner of the United Province of Agra and Oudh for the Year 1917, by Colonel C. Mactaggart, C.I.E., I.M.S., Officiating Sanitary Commissioner.

The Punjab.

Cholera caused 6,656 deaths in the Punjab during 1914 as compared with 5,811 in the previous year, the death-rate from the disease being for the two years respectively 0·34 and 0·30 per 1,000 of the population; the mean rate of the last five years' period was 0·13. Cholera deaths were recorded in 27 out of the 28 districts comprised in the province, the disease appearing in 66 towns and 672 villages during the year. For the first five months of 1914 the disease was practically absent from the Punjab, and it was not until June that any signs were observable of cholera beginning to assume epidemic proportions. The course of the 1914 prevalence is shown in the following table :—

1914.	Cholera Deaths.
January	4
February	2
March	—
April	—
May	4
June	250
July	595
August	3,283
September	2,102
October	259
November	147
December	10
Total	6,656

Of these deaths, 3,857 were males and 2,799 females. The districts which were most affected in 1914 were Amritsar, Lahore, and Jullundur :—

District.	Population in 1911.	Cholera Deaths.	Cholera Death-rate per 1,000 Population.
Amritsar	879,311	1,288	1·46
Lahore	1,017,742	788	0·77
Jullundur	787,956	750	0·95

The activity of cholera in June was shown by its appearance in 10 districts and two towns (Jhelum and Sialkot). The first cases in many of the invaded places were persons returning from Hardwar, "Vishnu's Gate" (in the United Provinces), one of the sacred spots of India, and one which attracts immense numbers of pilgrims every year in March and April for ceremonial bathing in the Ganges. The Sanitary Commissioner, in his Annual Report for 1914, again draws attention to the fact that during Ramzan, fasting Muhammedans, at sunset, when they are allowed to drink, take large quantities of water, or unboiled milk mixed with well-water, and in this way are liable to ingest large quantities of cholera bacilli. In the city of Amritsar (population, 151,339) 503 Muhammedans died of cholera, compared with only 214 Hindus; and in Jullundur city (population 55,354) the proportion of deaths from cholera was 123 Hindus to 362 Muhammedans.*

In 1915 cholera was epidemic during the summer months in the Punjab, and altogether 13,196 deaths were recorded, as compared with 6,656 in the previous year. The distribution of these fatal cases during 1915 is shown in the table below :—

1915.	Cholera Deaths.
January	3
February	—
March	10
April	877
May	4,390
June	3,607
July	2,145
August	1,796
September	331
October	29
November	8
December	—
Total	13.196

This number of cholera deaths is the largest since 1903. and it is suggested that this coincides with the holding of the great Kumbh Mela at Hardwar every 12 years. In 1903 the Punjab had 14,688 cholera deaths, and, as has been said, 13,196 in 1915. Many pilgrims from the Punjab attend this fair, and, as in 1915, cholera broke out at Hardwar when the pilgrims were assembling. They brought back the infection with them to their native villages and towns. The districts which had most deaths from cholera during the year were Ferozepore, with 2,890, giving a cholera death-rate of 3·10, and Lahore, 2,657 deaths, the mortality-rate being 2·61, the cholera death-rate for the whole province in 1915 was 0·68, the mean rate for the previous five years being 0·18. Other local outbreaks were traced to various religious fairs on a smaller scale, *e.g.*, the Ghariala and Kasur Tahsil fairs, some natives being attacked shortly after reaching their homes, and some being taken ill on the homeward journey. Local wells afterwards became specifically polluted and spread the disease. In the city of Lahore (population 210,271) about 430 wells were permanganated during a localised cholera outbreak which caused 86 deaths, the first four cases having just returned from Hardwar.

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* Report on the Sanitary Administration of the Punjab for the Year 1914, by Col. C. J. Bamber, I.M.S., Officiating Sanitary Commissioner.

Deaths from cholera were reported in all of the 28 districts of the province, 69 towns and 1,678 villages being infected. The general experience of the year was the importance of controlling the sanitary arrangements of all large fairs.

In 1916 the deaths from cholera fell to 1,651, yielding a mortality-rate of 0·09 per 1,000, the mean rate for the previous five years being 0·30. None of the districts suffered severely; the highest number of fatal cases occurred in Kurnal (197 deaths), Sialkot (186), Ferozepore (166), and Gujranwala (164). In several districts the infection was introduced by pilgrims returning from Hardwar; in one instance a patient arrived home by rail from that place in a moribund state, and died soon after he was taken to hospital. In another example, a person who arrived ill from Hardwar infected the family, and their clothes were washed at a well from which the people of the village mostly drew their drinking water. In the town of Panipat, population 26,342, in the Karnal district, an outbreak occurred towards the end of July, comprising 294 cases and 165 deaths. Of these fatal cases, 141 were Muhammedans. It is believed that the infection was imported from Muzaffarnagur, in the United Provinces.* The seasonal distribution of the 1,651 cholera deaths in 1916 is shown below :—

1916.	Cholera Deaths.
January	—
February	—
March	1
April	14
May	39
June	33
July	183
August	665
September	576
October	140
November	—
December	—
Total	1,651

During the first half of 1917 the Punjab was almost free from cholera, only three deaths being reported, namely, one in January, one in May, and one in June; but in July the disease began to increase in amount, 38 deaths being registered, 147 in

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* Report on the Sanitary Administration of the Punjab for the Year 1916, by Col. H. Hendley, K.H.S., I.M.S.

August, 628 in September, 463 in October, 86 in November, and none in December, making a total for the year of 1,365. The cholera death-rate being 0·07, against a mean of 0·30 for the previous five years.

It appears that cholera in the Punjab during the latter part of 1917 chiefly occurred amongst persons returning from their visit to Hardwar and other sacred places on the Ganges. At Jugadhri such an outbreak comprised 179 cases and 103 deaths, and another at Malka affected 56 persons, of whom 19 died. It is known that cholera was present at Hardwar (in the United Provinces) during August, and the authorities took steps to warn pilgrims to postpone their journey to that place. There was a somewhat prolonged prevalence of cholera amongst the troops and in the bazaars of the Lahore Cantonment, and as to which the Civil Surgeon and the Health Officer of Lahore were asked to render all possible assistance.*

The incidence of fatal cholera in the Punjab during the past 23 years is given in the subjoined table :—

Cholera Deaths in the Punjab from 1895 *to* 1917.

Year.	Cholera Deaths.	Cholera Death-rate per 1,000 living.
1895	541	—
1896	5,146	—
1897	622	—
1898	33	—
1899	1,816	—
1900	28,260	1·37
1901	180	0·01
1902	371	0·02
1903	14,688	0·73
1904	716	0·04
1905	2,197	0·11
1906	4,232	0·21
1907	437	0·02
1908	12,297	0·61
1909	1,513	0·08
1910	2,131	0·11
1911	1,260	0·06
1912	1,833	0·11
1913	5,811	0·30
1914	6,656	0·34
1915	13,196	0·68
1916	1,651	0·09
1917	1,365	0·07
Total in 23 years	106,952	—

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* Report on the Sanitary Administration of the Punjab for 1917, by Colonel H. Hendley, K.H.S., I.M.S.

The population of the Punjab at the 1911 census was 24,187,750, of which 4,212,794 were in the Native States.

The Central Provinces and Berar.

Cholera caused 20,345 deaths in the Central Provinces and Berar in 1914, as against 15,286 in 1913 and 34,313 in 1912. The death-rate from the disease during the year was 1·46, as compared with a mean rate of 0·97 for the five previous years, The prevalence continued throughout the months of 1914, but reached its height in September, as may be seen in the following table, which gives the number of deaths from cholera recorded in each month :—

1914.	Cholera Deaths.
January	230
February	791
March	2,186
April	1,293
May	1,783
June	1,929
July	1,375
August	3,528
September	4,472
October	2,190
November	458
December	110
Total	20,345

Of these fatal cases, 10,157 were males and 10,188 females. The districts in which the largest number of deaths from cholera were registered during the year were Nagpur, with 3,770 deaths and a death-rate from this disease of 4·65 per 1,000 of the population; Yeotmal (in Berar), 2,477, cholera death-rate, 3·42; Bhandara, 1,691 fatal cases and a death-rate of 2·19; Akola, 1,526 deaths and a rate of 1·93; Jubbulpore, 1,416, and a rate of 1·90; and lastly, Damoh, 1,399 deaths from cholera and a death-rate from that disease of 4·20 per 1,000 of the population. The Sanitary Commissioner, in his Annual Report for 1914,[*] again draws attention to the influence which religious fairs and pilgrimages have had in the diffusion of this disease in the Central Provinces and Berar, as in other parts of India. He mentions, for example, that at the Rinmochan fair in Amraoti district in January 1914 the large gathering of the people spread cholera in that and the Akola districts. In February the pilgrims from Bhandakpur fair infected Damoh, Saugor, and

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[†] Annual Sanitary Report of the Central Provinces and Berar for the year 1914, by Major T. G. N. Stokes, I.M.S., Sanitary Commissioner.

Jubbulpore districts. In March, the Mahadeo fair in Hoshangabad district caused a serious outbreak of cholera in Chindwara, Nagpur, and Bhandara districts. In April an influx of pilgrims from Puri (Orissa), and later from Nasir, in the Hyderabad State, re-infected the Raipur and Akola districts. The Bheraghat fair in Jubbulpore is quoted as another example of the danger arising from such gatherings, for 64 persons fell ill of cholera within 48 hours of leaving the fair. The importance, too, of the routes followed by the pilgrims is obvious, and the frequent association of cholera with such assemblies of people has suggested the existence of carriers among the class of ascetics whose lives are spent begging from one fair to another. The Sanitary Commissioner mentions the following measures as taken in the Jubbulpore district, suggesting that they might well be followed in other instances :—

(1) When the reporting of outbreaks was not prompt, the delay was brought to the notice of the Deputy Commissioner.

(2) Wells were permanganated by the police and staff specially deputed.

(3) The villages concerned were cleaned.

(4) Water guards were employed on contaminated supplies, and the cost recovered from malguzars (land owners) in cases where it seemed they were at fault.

(5) The issue of a short note on cholera and its treatment to touring officers with potash permanganate in crystals and pills.

The Sanitary Board for the Central Provinces has requested that schemes be drawn up, and an effort made, by local authorities, to provide protected wells at fairs, and along the principal routes to them.

There was a considerable decrease in the amount of fatal cholera reported in the Central Provinces during 1915, only 5,662 deaths being registered, as against 20,345 in the preceding year. The fatal cases were distributed over the months of 1915 as follows :—

1915.	Cholera Deaths.
January	9
February	—
March	2
April	9
May	40
June	373
July	796
August	2,294
September	937
October	790

1915.	Cholera Deaths.
November	362
December	50
Total	5,662

The sex distribution of these fatal cases was 2,949 males and 2,713 females. The largest number of deaths occurred in the districts of Bilaspur and Drug, which had, respectively, 1,648 and 1,078 fatal cases. The cholera death-rate in 1915 for the Central Provinces was 0·41, the mean rate for the five previous years being 1·14. The Sanitary Commissioner* once more repeats the statement that, in the year under consideration, as in former years, fairs played an important part in the spread of cholera in the Central Provinces. The epidemic, for example, in Bilaspur began with a pilgrim from Puri (Orissa), and resulted in 1,648 deaths, and from this district the infection was carried to Drug, where 1,078 other persons died, as well as to Raipur, where 624 more fatal cases occurred. The outbreak in Jubbulpore began with attacks among pilgrims returning from Guirghat fair, only 5 miles away, on the banks of the River Nerbudda, and ultimately 949 deaths resulted. There is also some evidence that an outbreak of cholera at Hoshangabad was due to pilgrims from Hardwar (United Provinces).

In 1916 the number of deaths from cholera in the Central Provinces and Berar increased to 39,205, giving a mortality-rate from the disease of 2·82 per 1,000, against a mean rate of 1·13 for the previous five years. The largest number of deaths from cholera were reported in the following districts, namely, Yeotmal (7,234 cholera deaths) and Amraoti (6,920), both in the Berar Division, and Nagpur (6,544) in the Nagpur Division. The course of the 1916 epidemic is shown in the next table, giving the number of fatal cases recorded in each month of the year :—

1916.	Cholera Deaths.
January	20
February	1
March	12
April	296
May	1,704
June	1,139
July	5,342
August	22,425
September	6,821

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* The Annual Sanitary Report of the Central Provinces and Berar for the Year 1915, by Lieut.-Col. W. B. Lane, I.M.S

1916.	Cholera Deaths.
October	1,142
November	286
December	17
Total	39,205

These deaths were nearly equally divided between the sexes, 19,858 being males and 19,347 females.

Owing to the high price of potassium permanganate and the difficulty of obtaining it, the use of hypochloride of lime was substituted to some extent for disinfection of water supplies, but it was not found to be so suitable.*

During 1917 cholera was greatly reduced in amount as compared with previous years, only 691 fatal cases being reported. The incidence of cholera mortality, month by month, during 1917 is shown in the subjoined table :—

1917.	Cholera Deaths.
January	1
February	38
March	105
April	302
May	123
June	74
July	5
August	—
September	8
October	27
November	8
December	—
Total	691

An outbreak occurred in May among the Kasia Labour Corps, 1,000 strong. While on their way to embark at Bombay the corps was detrained at Jubbulpore, as some cases of cholera had occurred on the journey; altogether 29 cases and 13 deaths were reported. Another outbreak appeared in October among the coolies at the irrigation works in the Bilaspur district, the infection having in all probability been introduced by pilgrims returning from Allahabad, 27 deaths resulting.†

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* Annual Sanitary Report of the Central Provinces and Berar for the Year 1916, by Col. W. H. B. Robinson, C.B., I.M.S., Sanitary Commissioner.

† Annual Sanitary Report for 1917 for the Central Provinces and Behar, by Col. C. R. M. Gren, I.M.S.

The progress of cholera from year to year in the Central Provinces and Berar from 1900 to 1917 is shown in the following table :—

Year.	Cholera Deaths.	Cholera Death-rate per 1,000 Population.
1900 - - -	81,489	7·14
1901 - - -	66	0·01
1902 - - -	44	0·00
1903* - - -	437	0·03
1904 - - -	2,967	0·24
1905 - - -	1,217	0·10
1906 - - -	38,768	3·26
1907 - - -	4,296	0·36
1908 - - -	9,048	0·76
1909 - - -	7,687	0·64
1910 - - -	5,316	0·44
1911 - - -	2,998	0·22
1912 - - -	34,313	2·46
1913 - - -	15,286	1·10
1914 - - -	20,345	1·46
1915 - - -	5,662	0·41
1916 - - -	39,205	2·82
1917 - - -	691	0·05
Total in 18 years -	269,835	—

The population of the Central Provinces and Berar at the census of 1911 was 13,916,308.

The North-West Frontier Province.

In this province during 1914 cholera deaths numbered 2,300, giving a death-rate from the disease of 1·13 per 1,000 of the population. In 1913 there were only 175 fatal cases, but in 1912 there were 1,329. The cholera mean death-rate for the last five years in the North-West Frontier Province was 0·32. The largest number of deaths in 1914 occurred in the Kohat, Bannu, and Peshawar districts :—

District.	Population in 1911.	Cholera Deaths.	Cholera Deaths per 1,000 of the Population.
Kohut - - -	216,704	1,116	5·15
Bannu - - -	244,949	589	2·40
Peshawar - - -	820,212	583	0·71

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* The figures regarding deaths from Cholera in Berar were added to those in the Central Provinces from 1903 onwards.

The population of the province in 1911 was 2,041,077. Of 290 villages in the Kohat district, 150 were infected by cholera during 1914. The first half of the year was practically free from the disease, only two deaths being reported in the Province in June. In July, 46 fatal cases were registered, and 878 in August. The epidemic reached its height in September, when 1,093 deaths occurred, falling to 52 in October. In November there was a slight increase, 151 fatal cases being registered, with 78 in December. The infection was largely spread by fugitives who carried it over various passes into other valleys; the efforts of the frightened people to escape created fresh centres of the infection. The Chief Medical Officer states, in his Annual Report,* that in only a few places was the disease in any way waterborne, and then only when a village well or streamlet became temporarily infected. Of the total 2,300 deaths in the province from cholera, 1,277 were males and 1,023 females.

In 1915 there were 932 deaths from cholera registered in four out of the five districts of the North-West Frontier Province, as compared with 2,300 in 1914. These deaths were distributed over the year as follows :—

1915.	Cholera Deaths.
January	—
February	—
March	—
April	28
May	325
June	154
July	24
August	91
September	148
October	100
November	61
December	1
Total	932

The districts of Peshawar and Hazara were the chief sufferers. In Hazara there were 635 deaths from the disease, giving a cholera mortality-rate of 1·25 per 1,000 of the population. Peshawar had 279 deaths and Kohat 17. A single fatal case occurred in the district of Bannu, and the district of Dera Ismail Khan had none. Of the total 932 cholera deaths in this province, 531 were males and 401 females. The cholera death-rate for the North-West Frontier Province in 1915 was 0·45 per 1,000 of the population, the mean rate of the previous five years being 0·54.[*]

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* Report on the Sanitary Administration of the North-West Frontier Province for the Year 1914, by Lieut.-Col. T. W. Irvine, I.M.S., Chief Medical Officer.

In 1916 the deaths from cholera in this province numbered 194, giving a death-rate from this disease of 0·09 per 1,000. With the exception of nine deaths in the Peshawar district, all the fatal cholera cases during 1916 were referred to the Dera Ismail Khan district, namely, 185, of which 69 occurred in the town of Dera Ismail Khan (population, 29,358) and 40 in Kulaohi (population, 10,178). The province was entirely free from cholera from January to the end of May, but in June 12 deaths were reported, 50 in July, 44 in August, 40 in September, 3 in October, 43 in November, and only 2 in December. The sudden rise in November was due to a local water-borne outbreak on the Tank-Pezu railway line, attributed to the wandering Powindahs,[†] whose encampments infest this district in the winter months.[‡]

There were no deaths from cholera in the North-West Frontier Province during 1917.

The incidence of fatal cholera in the North-West Frontier Province from 1901 to the end of 1917 is shown in the appended table :—

Year.	Cholera Deaths.	Cholera Death-rate per 1,000 Population.
1901	117	0·06
1902	—	—
1903	1,354	0·18
1904	1	—
1905	300	0·15
1906	—	—
1907	266	0·14
1908	2,854	1·49
1909	134	0·07
1910	1,605	0·84
1911	12	0·01
1912	1,329	0·65
1913	175	0·08
1914	2,300	1·13
1915	932	0·45
1916	194	0·09
1917	—	—
Total in 17 years	11,573	—

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[*] Report on the Sanitary Administration of the North-West Frontier Province for the Year 1915, by Lieut.-Col. T. W. Irvine, I.M.S., Chief Medical Officer.

[†] Travelling traders.

[‡] Report on Sanitary Administration of the North-West Frontier Province for the Year 1916, by Lieut.-Col. T. W. Irvine, I.M.S., Chief Medical Officer.

Assam.

In the province of Assam, 9,270 deaths were recorded from cholera in 1914, against 16,407 in 1913 and 14,303 in 1912. The death-rate from the disease was 1·53 per 1,000 of the population, compared with a mean rate of 2·66 for the five previous years. Of the fatal cholera cases, 2,350 were referred to the Surma Valley and 6,920 to the Assam Valley. The subjoined table gives the number of deaths from cholera reported, month by month, in Assam during 1914 :—

1914.	Cholera Deaths.
January	625
February	428
March	330
April	415
May	582
June	1,032
July	726
August	415
September	514
October	881
November	1,545
December	1,777
Total	9,270

As regards the sex distribution of these deaths, 4,884 were males and 4,386 females.

The district in which the largest number of cholera deaths occurred was Sibsagar, which had a population of 690,299 at the census of 1911. In it 3,510 of the deaths were recorded, giving a cholera mortality-rate of 5·08 per 1,000 of the population.

The Sanitary Commissioner for the province in his annual report* calls attention to frequent cases where cholera was spread by the people persisting in consuming the contaminated water of open streams flowing through towns and villages. In numerous instances the people, when taken ill, refused to accept any medical advice. As regards the prevalence of cholera in the Sibsagar district, the rainfall was scanty and caused scarcity of drinking water and concentration of pollution in the usual sources of supply. This epidemic began in June and reached its height in November, in which month 894 persons died of the disease.

The total number of cholera deaths reported from the tea estates (or gardens) was 769, or 1·09 per 1,000 of the population, as compared with 1,324 deaths in the previous year, and a cholera death-rate of 1·88.

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* Annual Sanitary Report of the Province of Assam for the Year 1914, by the Hon. Col. H. E. Banatvala, I.M.S., Sanitary Commissioner.

Cholera was more prevalent in Assam during 1915 than in the previous year, 26,979 deaths being reported as compared with 9.270 in 1914. The progress of the prevalence during 1915 is shown, month by month, in the subjoined table :—

1915.	Cholera Deaths.
January	837
February	486
March	870
April	1,324
May	1,180
June	697
July	715
August	1,037
September	2,630
October	5,158
November	7,300
December	4,745
Total	26,979

Of this total, 14,194 were males and 12,783 females. The cholera death-rate for 1915 in Assam was 4·46 per 1,000 living, the mean rate of the previous five years being 2·70. To the district of Sylhet, in the Surma Valley, 12,436 of the deaths were referred, and 4,536 to Goalpara in the Assam Valley. The total cholera deaths registered in the tea estates was 1,659, giving a death-rate of 2·36 per 1,000, the rate for the previous year having been 1·09.*

During 1916 there were 13,099 deaths from cholera, giving a death-rate from the disease of 2·16, the mean rate for the previous five years being 2·46. Of the total, 2,667 deaths were referred to the Surma Valley and 10,432 to the Assam Valley.

The districts which yielded the largest number of fatal cases were Darrang, with 2,513 deaths and a cholera mortality-rate of 6·66 per 1,000 living; and Sylhet, with 2,155 deaths and a rate of 0·87. The incidence of fatal cholera during the year is shown in the appended table :—

1916.	Cholera Deaths.
January	1,558
February	582
March	635
April	1,259

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* Annual Sanitary Report for the Province of Assam for the Year 1915, by Major T. C. McCombie Young, I.M.S., Sanitary Commissioner.

1916.	Cholera Deaths.
May	3,059
June	2,318
July	1,067
August	600
September	403
October	412
November	649
December	557
Total	13,099

The sex distribution of these deaths was 6,822 males and 6,277 females. In the tea estates there were 1,498 deaths from cholera, against 1,659 in the previous year.

Systematic and regular permanganation of wells was continued, The improvement of rural water supplies was vigourously carried out. The Sanitary Commissioner* reports "colossal ignorance of the people, and their reluctance to receive any help or treatment, or to practise any measures of prophylaxis or prevention."

During 1917 cholera was still prevalent in Assam, and up to the end of the year had caused 10,953 deaths; these were distributed over the months of the year as follows :—

1917.	Cholera Deaths.
January	157
February	165
March	871
April	1,880
May	3,544
June	2,405
July	994
August	231
September	151
October	103
November	201
December	251
Total	10,953

Of these 10,953 fatal cholera cases, 5,580 were males and 5,373 females. The cholera death-rate for 1917 in Assam was 1·81 per 1,000 of the population, against 2·64, the mean rate for the previous five years.

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* Annual Sanitary Report of the Province of Assam for the Year 1916, by Major T. C. McCombie Young, I.M.S.

The district which suffered the most from cholera during 1917 was Kamrap, in which 6,221 fatal cases were registered, giving a cholera mortality-rate of 9·31 per 1,000, against 1·81 for the whole province. The other districts which also suffered were Sylhet, with 1,590 deaths, and Darrang with 1,560; these three districts between them yielded more than 85 per cent. of the total cholera deaths registered in Assam during 1917.

All necessary measures were taken to check the spread of the disease in the early summer of 1917, when it began to threaten to become epidemic. These measures included disinfection of the water supplies, the sanitary disposal of dead bodies, and appropriate medical treatment.*

In the tea gardens or estates, 953 deaths from cholera occurred in 1917, as against 1,498 in the previous year.

For administrative purposes, Assam was formerly joined with Eastern Bengal, but at the beginning of 1912 it was separated and constituted a new province by itself. In giving a tabular summary of the occurrence of fatal cholera in this province it is only possible to give the deaths from 1912 onwards:—

Year.	Cholera Deaths.	Cholera Death-rate per 1,000 Population.
1912 - - -	14,303	2·36
1913 - - -	16,407	2·71
1914 - - -	9,270	1·53
1915 - - -	26,979	4·46
1916 - - -	13,099	2·16
1917 - - -	10,953	1·81
Total in six years -	91,011	—

The population of Assam, including the State of Manipur, at the beginning of 1912 was 7,059,857, of which 346,222 were in Manipur. In 1905 Assam was combined with Eastern Bengal for administrative purposes, but this combination was dissolved in 1911, and from 1912 Assam has been a separate province.

The general fall of late years in the cholera mortality of Assam is attributed to some extent to the improvement in the rural water supplies carried out in recent times, though much remains still to be done in this respect.

Burma.

The deaths from cholera in Burma during 1914 numbered 2,073 (2,042 in Lower Burma and 31 in Upper Burma), compared with 4,339 (3,704 in Lower and 635 in Upper Burma) in 1913.

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* Annual Sanitary Report of the Province of Assam for the Year 1917, by Major T. C. McCombie Young, I.M.S., Sanitary Commissioner.

The death-rate from the disease in this province in the year under review was 0·21 per 1,000 of the population, as against 0·44 in 1913, and a mean of 0·62 for the previous five years. The incidence of fatal cholera in Burma during 1914 is shown, month by month, in the table below :—

1914.	Cholera Deaths.
January	100
February	136
March	211
April	195
May	185
June	99
July	241
August	359
September	176
October	117
November	126
December	128
Total	2,073

Of these fatal cases, 1,269 were males and 804 females. The district which suffered most was Akyal (population in 1911, 527,766), in which cholera caused 1,041 deaths, the mortality-rate from the disease being 1·97 per 1,000. In the town of Bassein there were 115 fatal cases, giving a death-rate of 3·10. The seaport town of Rangoon had 37 deaths, and Moulmein 36, while Mandalay had only five.

The Sanitary Commissioner for Burma in his Annual Report for 1914 states that the prevalence of cholera in this province is generally associated with the use of polluted water drawn from unprotected sources. Many towns, however, are now being provided with safer supplies; as these are completed, the use of drinking water from surface wells and tanks will be discontinued, and if ample provision be made in rural areas of water from pure sources, Burma may be expected to enjoy comparative immunity from the ravages of cholera in the future. In the Municipality of Rangoon the appearance of the malady is now limited to that portion of the town to which the piped water supply has not yet been extended. Permanganating of wells, as far as possible, in the rural districts, and the prohibition of the use of suspicious sources of supply, have been generally effective in checking the spread of the disease when it has broken out. The ignorance and apathy of the rural population and the lack of a sufficient sanitary staff to render aid in the more remote areas, have facilitated the diffusing of the disease, as, for example, in the Akyal district mentioned above.*

In 1915 cholera continued to be prevalent in Burma, but in increased amount, and it became epidemic in the autumn. The incidence of fatal cholera in this province during the year is shown, month by month, in the following table :—

1915.	Cholera Deaths.
January	126
February	280
March	252
April	501
May	506
June	633
July	922
August	1,988
September	4,200
October	3,541
November	3,147
December	1,501
Total	17,597

Of these fatal cases, 8,209 were referred to Lower Burma and 9,388 to Upper Burma.

In August cholera broke out at the port of Mandalay, and up to the end of the year had attacked some 880 persons, of whom 759 died. Cholera occurred, too, during the year at the port of Rangoon, where 121 cases and 99 deaths were reported; also at the port of Bassein, where 150 persons were attacked and 113 died.

The figures given for cholera deaths, viz., 759, during 1915 in Mandalay do not represent the whole incidence of the disease, for, during July and up to the middle of August—that is, before the presence of cholera was officially recognised in the town—there had been an unusual and unprecedented mortality from bowel complaints, and this mortality decreased as cholera deaths became more numerous and widespread.

In the port of Rangoon, 25 cases and 16 deaths had occurred on incoming vessels during the voyage; the fatal cases had been buried at sea; and four cases occurred in ships lying in the port. Five more were found on board "riverine" vessels. Where cholera had occurred on board a ship, the water tanks were washed out with a concentrated solution of permanganate of potash.*

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* Report on the Sanitary Administration of Burma for the year 191[illegible], by Lieut.-Col. C. E. Williams, I.M.S., Sanitary Commissioner.

The cholera death-rate for the province of Burma in 1915 was 1·79 per 1,000 of the population (1·34 for Lower Burma and 2·52 for Upper Burma), against a mean rate for the five previous years of 0·41.

Excellent results were obtained in some districts in the treatment of cholera cases by the use of the hypertonic saline injections, as advocated by Sir Leonard Rogers, combined with the internal administration of permanganate of potash.

One of the civil surgeons suggested as a possible means by which cholera was spread in certain localities, the selling of foodstuffs by itinerant vendors who attend the local bazaars held every five days in different villages throughout the districts of Upper Burma.†

There was a great reduction in the mortality from cholera in Burma during 1916, for only 1,673 deaths were recorded, namely, 1,467 in Lower Burma and 206 in Upper Burma. The cholera death-rate in the province was 0·17 per 1,000 of the population, the mean rate for the five previous years being 0·72. The greatest incidence was in the first half of the year, as will be seen in the next table :—

1916.	Cholera Deaths.
January	660
February	305
March	256
April	274
May	114
June	33
July	13
August	2
September	3
October	5
November	1
December	7
Total	1,673

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* Annual Report of the Port Medical Officer for 1915, by Dr. F. Arthur Foy.

† Report on the Sanitary Administration of Burma for the Year 1915, by Lieut.-Col. C. E. Williams, I.M.S., Sanitary Commissioner.

At Rangoon there were 73 cholera deaths, 52 at Bassein and one each at the ports of Mandalay and Moulmein.

During 1916, 47 cholera cases at Rangoon were reported on incoming vessels, one on board an outgoing vessel, one on a ship lying in the harbour, and one on the foreshore.

During 1917 cholera continued to manifest itself in Burma, but not in any great amount. Up to the end of the year 1,914 deaths from the disease had been registered, 1,886 of which were referred to Lower Burma and 28 to Upper Burma. The death-rate from cholera for 1917 in the province of Burma was 0·19, as compared with a mean rate of 0·67 for the previous five years. The seasonal distribution of the cholera deaths in 1917 was as follows:—

1917.	Cholera Deaths.
January	71
February	136
March	645
April	286
May	463
June	170
July	91
August	17
September	8
October	—
November	18
December	9
Total	1,914

Of the 1,886 fatal cases in Lower Burma, 657 occurred in the Ma-ubin district, to which cholera was brought by pilgrims returning from attending a religious ceremony early in March at Pantanaw. The Irrawady Division, with a population of 1,869,485, in which Ma-ubin is included, furnished 1,214 out of the total 1,886 cholera deaths reported during the year in Lower Burma, and had a cholera mortality-rate of 0·65. The population of Lower Burma is about six millions.

In Rangoon during 1917 there were 76 reported cholera cases and 49 deaths; 48 of the cases were imported. The greatest incidence of cholera in Rangoon was in the months of April and May; 47 of the cases were found on incoming vessels.

The fatal incidence of cholera in the four chief ports of Burma during the last seven years is shown in the subjoined table :—

Cholera in Burmese Ports, 1911 *to* 1917.

——	Population, 1911.	Cholera Deaths.						
		1911.	1912.	1913.	1914.	1915.	1916.	1917.
Lower Burma—								
Rangoon - -	293,316	147	156	50	37	99	73	49
Bassein - -	37,018	23	243	262	115	113	52	81
Moulmein - -	58,754	48	68	21	36	—	1	18
Upper Burma—								
Mandalay - -	138,666	209	115	3	5	759	1	5

The number of cholera deaths recorded in the Province of Burma during the last 19 years is given in the appended table :—

Cholera Deaths in Burma, 1899 *to* 1917.

Year.	Lower Burma.	Upper Burma.	The Province of Burma.	Cholera Death-rate per 1,000 Population.
1899 - -	4,942	2,050	6,992	0·74
1900 - -	3,440	41	3,481	0·77
1901 - -	3,552	—	3,552	0·64
1902 - -	1,844	57	1,901	0·33
1903 - -	5,346	2,887	8,233	0·97
1904 - -	2,472	508	2,980	0·45
1905 - -	3,511	1,836	5,347	0·63
1906 - -	5,529	2,343	7,872	0·93
1907 - -	7,964	414	8,378	0·99
1908 - -	9,336	2,757	12,093	1·40
1909 - -	4,041	7,348	11,389	1·33
1910 - -	1,834	177	2,011	0·24
1911 - -	2,595	1,596	4,191	0·42
1912 - -	6,013	1,173	7,186	0·73
1913 - -	3,704	635	4,339	0·44
1914 - -	2,042	31	2,073	0·21
1915 - -	8,209	9,388	17,597	1·79
1916 - -	1,467	206	1,673	0·17
1917 - -	1,886	28	1,914	0·19
Total in 19 years.	79,727	33,475	113,202	—

The population of the Province of Burma at the census of 1911 was 12,115,217.

The Central India Agency.

The Central India Agency has an area of 77,367 square miles, and at the census of 1911 its population was 9,356,980. During 1914 cholera was epidemic in this administrative area, which comprises a number of Native States. Altogether 10,075 deaths from the disease were recorded, 4,205 of which were referred to the State of Gwalior and 3,878 to Bundelkhand. In 1913 the fatal cases of cholera in the Central India Agency amounted to 2,823, and in 1912 to 9,080. The main prevalence of cholera in 1914 was in the summer and autumn months. The outbreaks in Gwalior and Bundelkhand began almost simultaneously in May, and lasted till October. The following table shows, month by month, the progress of fatal cholera in Gwalior, Bundelkhand, and in other States in the Central India Agency during 1914 :—

Cholera Deaths in the Central India Agency.

1914.	Gwalior (population 1911, 3,090,798).	Bundelkhand (population 1911, 1,375,317).	Baghelkhand (population 1911, 1,772,574).	Bhopal (population 1911. 1,050,735).	Other States.	Total Cholera Deaths.
January -	—	—	1	—	3	4
February -	—	—	6	—	—	6
March	—	3	10	—	11	24
April -	—	7	25	48	9	89
May - -	102	122	86	3	74	387
June - -	1,039	173	79	118	65	1,474
July - -	974	241	198	190	35	1,638
August -	1,441	597	233	144	53	2,468
September -	433	1,571	100	216	23	2,343
October -	190	1,110	128	38	—	1,466
November -	23	54	90	2	—	169
December -	3	—	4	—	—	7
Total -	4,205	3,878	960	759	273	10,075

The southern portion of the Native States of Central India remained free from cholera during 1914.

In 1915 cholera was less prevalent in the Central India Agency than in the previous year, 795 deaths being recorded from the disease, as compared with 10,075 in 1914. The largest number of fatal cases occurred in the State of Baghelkhand, namely, 396. The height of the prevalence was reached in the months of July and August. The monthly incidence of cholera in each of the affected States is shown in the following table* :—

1915.	Gwalior.	Bhopal.	Baghel-khand.	Southern States of Central India.	Total Cholera Deaths.
January -	—	—	—	—	—
February -	—	—	—	—	—
March - -	—	—	—	—	—
April - -	65	—	26	—	91
May - -	60	—	—	23	83
June - -	—	—	49	—	49
July - -	68	59	117	—	244
August - -	—	20	104	—	124
September -	—	28	65	—	93
October -	—	13	18	30	61
November -	—	9	17	—	26
December -	—	24	—	—	24
Total -	193	153	396	53	795

During 1916 cholera was widespread in the Central India Agency and caused 5,474 deaths, the disease having appeared in every division. The 1916 epidemic reached its height in July and August, in which respectively 1,682 and 2,288 cholera deaths were recorded. The winter months were comparatively free from the malady. Bhopal had 1,708 deaths and Gwalior 1,682. The course of the epidemic, month by month, in the different parts of the Central India Agency, is shown in the subjoined table :—

Deaths from Cholera in the Central India Agency in 1916.†

1916.	Bhopal.	Gwalior.	Indore.	Malwa.	Bundel-khand.	Southern States.	Baghal-khand.	Total.
January -	—	—	—	—	—	—	—	—
February -	—	—	—	—	—	—	—	—
March -	—	—	—	—	—	11	—	11
April - -	—		2	—	—	22	—	24
May - -	—	60	—	—	—	12	30	132
June - -	325	98	32	1	—	19	13	488
July - -	530	133	422	494	60	25	18	1,682
August -	748	826	352	223	89	50	—	2,288
September -	102	565	41	—	67	35	—	810
October -	3	—	22	—	8	—	—	33
November -	—	—	—	—	6	—	—	6
December -	—	—	—	—	—	—	—	—
Total -	1,708	1,682	871	718	230	204	61	5,474

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* The figures for 1914 and 1915 are taken from the Annual Reports of Lieut.-Col. F. A. Smith, I.M.S., Administrative Medical Officer in Central India.

† This Table is taken from the Annual Report on the Registration of Vital Statistics for the fiscal year 1916-17, by Lieut.-Col. F. A. Smith, I.M.S., Administrative Medical Officer for Central India.

Cholera was comparatively absent from Central India during 1917, only 589 deaths being recorded. The greater portion of these fatal cases occurred in Bundelkhand and Baghelkhand. Bhopal, Indore, Gwalior, and the Southern States were free from cholera during 1917.

The incidence of fatal cholera in the Central India Agency since 1900 is shown in the following table:—

Year.	Cholera Deaths.
1900	20,450
1901	72
1902	12
1903	1,110
1904	150
1905	27
1906	10,147
1907	413
1908	1,730
1909	1,421
1910	2,864
1911	1,054
1912	9,080
1913	2,823
1914	10,075
1915	795
1916	5,474
1917	589
Total in 18 years	68,286

The population of the Central India Agency at the census of 1911 was 9,356,980.

Rajputana and Ajmer-Merwara.

Including 10 cases and 9 deaths in Ajmer-Merwara, cholera caused 3,195 attacks and 1,627 deaths in the Rajputana Province during 1914, compared with 6,533 cases, of which 4,085 were fatal, in 1913. No cholera was reported during the first two and the last two months of the year, the prevalence beginning in March and subsiding in October, as may be seen in the following table :—

1914.	Cases.	Cholera Deaths.
January	—	—
February	—	—
March	8	7
April	137	74
May	1,030	538
June	694	396
July	386	194
August	766	348
September	171	67
October	3	3
November	—	—
December	—	—
Total	3,195	1,627

The case mortality-rate was 50·92 per cent. The largest incidence was reported in the State of Kotah, in which, between May and October, 1,999 persons were attacked by cholera, of whom 1,030 died, and of these, 687 cases and 353 deaths were referred to the city of Kotah (population, 33,624). Cholera appeared in the State of Tonk in April, and up to September 491 cases and 217 deaths were recorded: of these, 303 cases and 116 deaths occurred in the city of Tonk (population, 40,000). In the Jhalawar State during the same period 363 attacks and 176 deaths occurred; and in the State of Bikaner 170 persons were attacked, of whom 77 died.*

During 1915, in Rajputana and Ajmer-Merwara, 2,961 cases of cholera were reported, with 1,981 deaths, giving a case mortality-rate of 66·9 per cent. Only three fatal cases were referred to Ajmer-Merwara, all the rest occurring in Rajputana. The State of Marwar was the heaviest sufferer, having 1,915 attacks and 1,350 deaths referred to it, and Jaipur 497, of which 287 were fatal. The seasonal incidence of cholera during the year is shown, month by month, in the following table :—

1915.	Cases.	Cholera Deaths.
January	—	—
February	—	—
March	40	30
April	579	378
May	508	374
June	1,009	639

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* Report on Sanitation, etc., in Rajputana for 1914, by Lieut.-Col. R. Charles Macwatt, I.M.S., Chief Medical Officer.

1915.	Cases.	Cholera Deaths.
July	445	281
August	209	149
September	75	63
October	55	52
November	40	15
December	1	—
Totals	2,961	1,981

Cholera was imported into the State of Alwar by a resident who had been to the Hardwar fair (United Provinces), where at the time the disease was epidemic, and, as a result, 132 cases with 67 deaths occurred.*

Cholera was epidemic in 1916, attacking 7,941 persons, of whom 5,065, or 63·71 per cent., died. Of these, 1,172 cases and 888 deaths were referred to Ajmer-Merwara, and 6,770 cases and 4,177 deaths to Rajputana. In the latter, the largest number of attacks occurred in Marwar State, namely, 1,344 (with 972 deaths), Mewar State having 1,134 (585), Alwar State, 1,136 (551); and Jaipur city, 687 (677).

The following table gives the seasonal distribution of cholera in Ajmer-Merwara and Rajputana during 1916 :—

1916.	Cases.	Cholera Deaths.
January	—	—
February	—	—
March	—	—
April	10	5
May	715	542
June	1,782	1,215
July	1,813	1,189
August	2,443	1,459
September	910	487
October	219	129
November	48	38
December	1	1
Total	7,941	5,065

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* Annual Report on Sanitation, etc., in Rajputana for 1915 by Lieut.-Col. R. Chas. Macwatt, I.M.S., Chief Medical Officer.

The distribution of the cholera deaths in Ajmer-Merwara and Rajputana during 1916 in the various States and districts is shown in the following table* :—

States and Districts.	Population in 1911.	Deaths from Cholera.	Cholera Deaths per 10,000 of the Population.
Ajmer-Merwara - -	501,395	888	17·72
Bharatpur - - -	558,785	261	4·67
Jaipur - - - -	2,636,647	847	3·21
Dholpur - - -	263,188	47	1·79
Bikaner - - -	700,883	38	0·54
Marwar - - -	2,057,553	972	4·72
Mewar - - - -	1,293,776	585	4·52
Kotah - - - -	639,089	236	3·69
Jhalawar - - -	96,271	151	15·68
Shapura - - -	47,397	36	7·59
Kishengarh - - -	87,191	167	19·15
Tonk - - - -	303,181	138	4·55
Deoli Cantonment -	5,205	6	11·53
Sirohi - - - -	189,127	86	4·55
Alwar - - - -	791,688	551	6·96
Erinpura Cantonment -	3,033	6	19·78
Karauli - - -	146,587	50	3·41
Totals - -	10,320,996	5,065	4·91

There was a considerable reduction in the number of cholera cases and deaths during 1917. 89 attacks and 69 deaths were referred to the Native States in Rajputana and 12 deaths in the Ajmer-Merwara district, all of the latter occurring in Ajmer city. The Native States of Rajputana that were chiefly affected were Jaipur, with 37 cases (and 36 deaths), and Bharatpur, 41 (19).

The following table gives for each year from 1906 the number of cholera deaths in Rajputana and Ajmer-Merwara :—

Year.	Cholera Deaths.
1906 - - - - - - -	4,998
1907 - - - - - - -	65
1908 - - - - - - -	737
1909 - - - - - - -	403
1910 - - - - - - -	10
1911 - - - - - - -	135
1912 - - - - - - -	427
1913 - - - - - - -	4,085

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* Compiled from the Annual Report for the year 1916 on the Sanitation etc., of Rajputana, by Lieut.-Col. R. Charles Macwatt, I.M.S., Chief Medical Officer in Rajputana.

Year.	Cholera Deaths.
1914	1,627
1915	1,981
1916	5,065
1917	81
Total	19,614

Delhi.

There were only 12 deaths from cholera in the province of Delhi during 1914, of which 10 were referred to the city of Delhi. In the previous year 37 fatal cases had been recorded in the province, 24 of them being referred to the city. In 1912 the disease was epidemic, causing 406 deaths, but the number of those occurring in Delhi city has not been stated.

During 1915 there were 92 deaths from cholera registered in the province, and of these, 81 occurred in the city. The greatest prevalence was in April, in which month 100 of the total deaths were recorded.

In 1916 cholera caused 69 deaths in the province of Delhi, of which 48 occurred in Delhi city and 21 in the outside districts. During 1917 only 12 fatal cases of cholera were recorded.

As Delhi was constituted a separate province in 1912, having previously been included in the Punjab, it is possible to give the reported cholera deaths only from that time onwards. The following table gives the number of fatal cholera cases that occurred in Delhi province from 1912 to 1917 :—

Year.	Cholera Deaths.
1912	406
1913	37
1914	12
1915	92
1916	69
1917	12
Total in six years	628

The population of the province of Delhi in 1912 was 391,828, of which 232,837 resided in the city of Delhi itself.

Coorg.

There were no reported deaths from cholera during 1914 in the small province of Coorg, which has an area of 1,583 square miles and had a population of 174.976 at the census of 1911. In 1913, 192 fatal cases had been recorded. During 1915 no cholera deaths seem to have occurred, and only a single fatal case in 1916. During 1917 there were 32 deaths from cholera in Coorg.

The past records of Coorg do not show any great incidence of cholera in it during recent years. The subjoined tabular statement gives the number of deaths from the disease reported year by year in Coorg since 1900 :—

Year.	Cholera Deaths.
1900	—
1901	58
1902	—
1903	—
1904	—
1905	—
1906	10
1907	187
1908	114
1909	99
1910	56
1911	6
1912	—
1913	192
1914	—
1915	—
1916	1
1917	32
Total in 18 years	755

The State of Mysore.

During 1914 cholera deaths in the State of Mysore numbered 849, as compared with 8,062 in 1913. No details of the 1914 prevalence of cholera in this Native State have come to hand. In 1915 there were only 178 fatal cases of cholera recorded in Mysore and 137 in 1916. During 1917 cholera was epidemic in Mysore, 7,288 deaths being recorded.

Beyond the figures given above, no details of the incidence of the disease in any of the years have come to hand.

The occurrence of fatal cholera in the State of Mysore from 1894 to 1917 is shown, year by year, in the subjoined table :—

Year.	Cholera Deaths.
1894	328
1895	2,334
1896	2,100
1897	4,248
1898	1,193
1899	123
1900	779
1901	11,351
1902	218
1903	98
1904	471
1905	626
1906	7,223
1907	4,972
1908	2,449
1909	1,629
1910	1,812
1911	210
1912	6,743
1913	8,062
1914	849
1915	178
1916	137
1917	7,288
Total in 24 years	65,421

The area of the Mysore State is about 30,000 square miles and its population at the 1911 census was 5,806,193.

THE STATE OF HYDERABAD.

Hyderabad, or the Nizam's Dominions, a feudatory State of India, is situated on the central plateau of Southern India, and lies between the Presidencies of Madras and Bombay. Its population at the last census was 13,375,676.

Cholera was prevalent in this Native State during 1914, causing 5,893 deaths, as compared with 1,322 in 1913. In 1915 the cholera prevalence continued and 2,072 fatal cases were recorded. During 1916 the deaths from cholera numbered 1,475, and in 1917, 2,579.

The above figures include the whole State of Hyderabad as well as the cantonment stations. Up to 1913 the Sanitary Commissioner with the Government of India, in his Annual Report, only gave the number of cholera deaths occurring in the cantonment stations, so that up to that year no satisfactory record is available as to the incidence of fatal cholera in the rest of the Hyderabad State.

The following table shows the number of deaths from cholera in the Hyderabad cantonment stations, year by year, from 1894 to 1912 and from then to 1917, the fatal cholera cases in the Hyderabad State:—

Year.	Cholera Deaths.
1894	1,862
1895	467
1896	525
1897	1,039
1898	6
1899	—
1900	3,813
1901	1
1902	—
1903	—
1904	—
1905	64
1906	1,061
1907	1
1908	937
1909	164
1910	2
1911	803
1912	1,190
1913	1,322*
1914	5,893*
1915	2,072*
1916	1,475*
1917	2,579*
Total in 24 years	25,276

BALUCHISTAN.

Cholera broke out in June 1916 at Zhob, in Northern Baluchistan, near the borders of Afghanistan. Altogether 35 villages were invaded, with a total of 328 cases and 174 deaths, giving a case mortality-rate of 53 per cent. The outbreak was ascribed locally to infection brought into Zhob by a party of Powindahs, or travelling traders, from the Punjab on their way back to Afghanistan. So far there is no information as to the occurrence of cholera in Baluchistan during 1917.

FRENCH SETTLEMENTS IN INDIA.

Pondicherry, the chief of the French Settlements in India, lies on the Coromandel coast, 90 miles to the south of Madras, and has a population of 185,000. *Karikal* is the second in importance of the French Settlements, and is also situated on the Coromandel coast, 12 miles to the north of Nagapatam: it has a population of 57,000. A distance of about 75 miles separates these two French Settlements. Cholera was epidemic in both of them during 1914, and, according to the Annual Report of the British Consul on the trade of Pondicherry and Karikal, the deaths in them from the disease amounted to 1,423.

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* Figures for the whole of the Hyderabad State.

On local authority it is asserted that epidemic outbreaks of cholera in Pondicherry and Karikal are due to bad hygienic conditions, to predisposition caused by the sudden fall of temperature, the result of the heavy rains, and to the formation of pools of water which are "excellent culture media for the vibrios." The fatalism of the natives and their social habits make the application of preventive measures very difficult.

No reports from the French Settlements in India have been received at the time of writing for the three years 1915, 1916, and 1917, probably in circumstances arising from the war.

CEYLON.

There was no cholera epidemic in Ceylon during 1914, but several groups of cases were reported in different localities. At Colombo, the capital of the Colony, and having a population of 185,704, 13 cases, with 12 deaths, were notified; and at Galle (or Point de Galle), a seaport on the south-west extremity of the island, with 40,000 inhabitants, 12 cases and one death came under observation. Several cases were reported in June at a village in the Uda Pussellaw district, but no details have been furnished.

There is little information as to cholera in Ceylon during 1915, except that eight deaths were certified from the disease.

In May 1916 an outbreak of cholera occurred at the port of Colombo, some 87 cases and 44 deaths being recorded. On 30th April the s.s. "Peiho" from Saigon, carrying 2,285 Annamist labourers to Marseilles, arrived at Colombo and landed, for burial on shore, the body of a coolie who had died of cholera just before the ship reached port. On 9th May the ss. "Hong Kong," from Haiphong (Indo-China), arrived at Colombo and reported that she had three cholera cases on board, and that 17 others had occurred on the voyage from Haiphong to Colombo. There were 2,653 coolies from Annam on the vessel, and while she was being detained at Colombo 38 cholera cases appeared among the coolies, 19 of whom died in hospital and six on the ship before they could be landed. Altogether, in connection with the s.s. "Hong Kong," 64 cholera cases were recorded, with 37 deaths. Both the "Peiho" and the

"Hong Kong," after complying with the regulations at Colombo, proceeded on their voyage to Marseilles *viâ* Suez. (*See also* under Indo-China and Egypt.)

No information has been received as to the occurrence of cholera in Ceylon during 1917.

THE DUTCH EAST INDIES.

Cholera appeared during 1914 in the Dutch East Indies and was prevalent in the islands of Java, Sumatra, Borneo, and Celebes. So far as the published returns show, there were recorded in the year about 4,166 cases and 2,760 deaths, giving a case mortality-rate of 66·2 per cent. In the previous year 4,368 cases and 4,252 deaths had been reported, with the high case mortality-rate of 97·3 per cent.

Java.—Cholera attacked 1,030 persons in Java during 1914, and of these 914 died, the majority of the cases being referred to Batavia and Tandjong Priok. In the previous year 1,233 cases and 1,036 deaths from cholera had come under official notice in the island.

Sumatra.—In Sumatra 1,892 cases and 1,018 deaths were recorded from cholera during 1914, and 458 of those attacked belonged to the district of Moeraboengoe, in the province of Djambi, which is in the south of the island. In 1913 the cholera attacks reported in Sumatra numbered 823 and the deaths 488.

Borneo.—In the Dutch portion of Borneo 140 cholera cases came under observation during 1914, with apparently only 28 deaths. The majority of the attacks occurred in the western part of the island, and only a single case was recorded in the town of Pontianak, the capital of the western division of Borneo. In the previous year 57 cases and 40 deaths from cholera were observed in the Dutch part of this island.

Celebes.—In 1914, cholera attacked 1,104 persons, of whom 800 died; 863 of the attacks (and 582 of the deaths) were referred to the Presidency of Menado, and 223 (201) to Macassar, the chief town of Celebes. In 1913 cholera was epidemic in this island, and 2,235 cases with 1,688 deaths were reported during the year.

In 1915 cholera reappeared in Java, Sumatra, and Borneos In Java the disease attacked 353 persons, of whom 238, or 67·4 per cent., died; the chief area in which cholera was present in Java during 1915 was the seaport town of Batavia, where 181 fatal cases were reported. In Sumatra the disease was prevalent chiefly in the Toba district, where 159 cases and 110 deaths occurred. In the Dutch portion of the island of Borneo cholera appeared in the south and east, especially at the port of Bandjermassin and at Simporna; in the latter 67 deaths were attributed to cholera in the first quarter of 1915. Cholera was also present during October in the island of Amboyna, one of the southern group of the Moluccas, or Spice Islands, which form the easternmost division of the Malay Archipelago.

During 1916 cholera was still prevalent in the Dutch East Indies, and among other places infected were the ports of Samarang in Java, and Amboina and Macassar in the Molucca group. The chief incidence was in the island of Java, in which 2,284 cases and 1,022 deaths were reported, giving a case mortality-rate of 44·7 per cent. In Batavia, which is the capital of the Dutch East Indies and has a population of 145,000, 160 persons were attacked by cholera, of whom 115 died. Cases also occurred in the provinces of Pasoeroean and Soerabaya, but not in large amount.

During 1917 cholera was still appearing in Java, but not to a great extent, for only 503 cases and 260 deaths were recorded; of these, 140 occurred in the town of Batavia, of which 80 had a fatal termination. There is no information to show that cholera was present during 1917 in any of the other islands of the Dutch East Indian Archipelago.

British Borneo.—In the British portion of the island of Borneo cholera was present during 1915, in three localities, namely, Bode, Putatan, and Sandakan, but not in any great amount. No reports relating to cholera in British Borneo during 1916 and 1917 have been received.

THE STRAITS SETTLEMENTS.

During 1914, 289 cases and 199 deaths were recorded from cholera in the town of Singapore, the prevalence having reached its height in the months of April and May. The figures for 1913 were 275 cases, but only 58 deaths.

In December 1914 the s.s. "Atreus" from Kobe for Liverpool, called at the port of Singapore and landed at the quarantine station a person who had been attacked by cholera on the voyage from Japan. In the province of Wellesey cholera was prevalent during the month of March 1914, 147 cases being reported, of which number 100 terminated fatally. A single case of cholera occurred in the town of Penang during 1914, the sufferer having been a recent arrival from the State of Kedah, Federated Malay States, where the disease had been seriously epidemic for some time. Little was heard of cholera in the Straits Settlements during 1915, but 12 deaths came under official notice in Singapore.

During 1916, there were 17 fatal cholera cases at Singapore and, in the first half of 1917, 10 others. A single fatal case was reported at Penang in March 1917, but no details are to hand regarding those instances which occurred in 1916 and 1917.

The incidence of cholera in the town of Singapore during the past ten years is shown in the following table :—

Cholera in Singapore 1908 *to* 1917.

Year.	Cholera.		Case Mortality.
	Cases.	Deaths.	Per cent.
1908 - - - -	130	113	86·9
1909 - - - -	58	52	89·7
1910 - - - -	137	125	91·2
1911 - - - -	260	222	85·4
1912 - - - -	122	107	87·7
1913 - - - -	275	58	21·1
1914 - - - -	289	199	68·8
1915 - - - -	13	12	92·3
1916 - - - -	*—	17	—
1917 - - - -	*—	10	—
Totals - -	1,284	915	—

THE FEDERATED MALAY STATES.

During 1914 there was a rather severe outbreak of cholera in the State of Perak,† 506 cases and 230 deaths being recorded. In the State of Selangor some 57 persons were attacked by cholera during the year, and of these 53 died. In the State of Kedah cholera, which has been occurring there almost every year for some time past, broke out again in and around Alor Star, the prevalence lasting about five months. The outbreak began in November 1913 and continued up to June 1914, attacking 2,196 persons, of whom 1,502, or 68 per cent., succumbed. It is admitted however, that these were not all the attacks that occurred, for there was undoubtedly a good deal of concealment of cases by the natives. It has been estimated that since 1907 up to the end of 1914 some 5,500 persons have died from cholera in the State of Kedah. During these years there has been no evidence of imported infection, the outbreaks arising apparently from the endemic disease.‡

From Kedah the infection was carried to the adjoining State of Perlis causing 45 attacks and 40 deaths. Some cholera cases also were reported in the State of Trengganu, but the precise number has not been stated.

No reports for 1915, 1916, or 1917 had been received up to the time that this report was written.

SIAM.

At Bangkok, the capital of Siam, situated on the banks of the River Menam, and having a population of about 630,000.

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* The precise number of attacks was not ascertained.

† Report for 1914 on the Federated Malay States. Presented to both Houses of Parliament by Command of His Majesty, January, 1916.

‡ Reports for 1914 on the States of Kedah and Perlis, Kelantan, and Trengganu. Printed in the Federated Malay States, December, 1915.

cholera caused 473 deaths during 1914, as against 120 in the previous year, 1,922 in 1912, and 2,305 in 1911. The number of persons attacked by the disease has not been stated. Cholera also appeared in several other localities during the year. At Patani during May and June 69 deaths were recorded, and 108 at Patalang. In the same period 50 more deaths from this disease occurred in Sengora. In smaller amount cholera was present in the summer months at Trang, Palien, and Puket; in the last-mentioned place 40 persons were attacked. In the Annual Report of the British Consul at Sengora, for 1914, it is stated that outbreaks of cholera of more or less severity occur every year during the hot season, and that the disease may be regarded as endemic in that locality.

During 1915, so far as can be learned, only 20 deaths from cholera occurred in the city of Bangkok, most of them in the first half of the year. At Trang about 8 or 10 cases were reported early in the year, but after that nothing more was heard of the disease at Trang during the remainder of 1915.

Cholera continued to be present in Bangkok during 1916, though not in epidemic form, some 25 deaths being reported up to August. So far as is known only a single death from cholera was recorded in Bangkok during 1917.

INDO-CHINA.

The returns as to cholera in French Indo-China during 1914 are incomplete, but so far as they go they show that 886 cases and 578 deaths from the disease were recorded, as compared with 432 (and 313 deaths) in 1913, and 16,656 (10,560) in 1912. The disease was present during the year in Tonkin Annam, Cochin china, Cambodia, and Laos.

In the State of Tonkin about 172 cases and 79 deaths were recorded, and of the cases 62 occurred at the town of Ninh-Binh and 50 at Haidong (or Haidzouong).

From the State of Annam the returns are incomplete, but at least 188 cases and 107 deaths appear to have come under observation. Of these 122 cases were referred to Binh-Dinh and 48 to Than-Hoa.

In Cochinchina there were 471 cholera cases during the year, and of these, 357 died; 265 of the cases and 142 deaths were referred to the town and port of Cholon. In Cambodia only 43 cases and 23 deaths came under official notice, 25 of the cases occurring at Tukeo. In Laos there were only 12 cases of cholera reported during the year, with 11 deaths; but it is admitted that these returns are far from being complete.

For the year 1915 the returns are not yet complete, but it is known that about 9,894 persons were attacked and that of these, some 6,326, or 63·9 per cent., died. As in the previous year cholera occurred in Tonkin, Annam, Cochinchina, Cambodia, and Laos. The chief sufferers were Cochinchina in which, up to the end of September, 3,890 cases and 2,185 deaths had been reported, 830 of the attacks and 550 of the deaths being referred to the port of Cholon; only 63 cases and 33 deaths occurred in Saigon, the capital of Cochinchina, situated on the Mekong River about 60 miles from the sea. In Tonkin, up to December 3,368 persons were attacked by cholera, and of these, 1,969, or 58·5 per cent., died; over 1,000 cases and 634 deaths were reported at Haiduong, and 937 attacks, 571 of which were fatal, at Hanor. In Annam, 1,732 cholera cases with 1,326 deaths were recorded during 1915; and in Cambodia 858 attacks came under observation, of which 569 proved fatal. Laos had only 152 cases and 95 deaths from cholera during the year.

In 1916 the number of reported cholera cases in Indo-China amounted to 10,775, and the deaths to 8,413, giving a fatality-rate of 78·1 per cent. It is probable that the deaths were more accurately recorded than the attacks, since the case mortality-rate is higher than is usual in cholera. As regards the individual States, Annam seems to have suffered most, having had, approximately, 5,962 cases and 4,233 deaths. Among the places involved in Annam were Hatinh, with 1,867 cases and 1,787 deaths, and Nghé-An with 1,229, of which 808 were fatal. The State of Tonkin appears also to have been affected somewhat severely, 4,015 cases and 2,174 deaths being reported. Cambodia, Cochinchina, and Laos were only slightly involved. In the leased territory of Quang-Tcheon-Wan about 604 cases and 293 deaths from cholera were recorded during 1916. The following table gives the number of cholera cases and deaths reported in Indo-China, month by month, during 1916:—

1916.	Cholera Cases.	Cholera Deaths.
January February	1,332	762
March	686	338
April	847	940
May	1,789	1,679
June	1,904	1,250
July	2,907	2,374
August	872	754
September	107	82
October	103	76
November	151	114
December	77	44
Total	10,775	8,413

In connection with the prevalence of cholera in Indo-China the disease broke out in at least two ships conveying Annamite labourers to France to work behind the lines. One of the ships had 2,285 coolies shipped at Saigon, and in connection with this vessel, on the voyage and after its arrival at Suez, 136 persons were attacked by cholera, and of these 66 died. In consequence the ship, with its passengers, was sent back to Indo-China. Another vessel left Haiphong (in Tonkin) with 2,653 coolies for Marseilles, and on her arrival at Suez the master reported that 55 cases of cholera, with 33 deaths, had occurred on the voyage. In view of these occurrences and the probability that there were chronic carriers of the cholera infection among the Annamite coolies, the French Government abandoned the project of supplying labourers from Indo-China for war work behind the lines in France.

In 1917 cholera was still prevalent in Indo-China, but in considerably reduced amount compared with the two previous years. Up to the end of the year, 2,307 attacks were reported, of which 1,426, or 61·8 per cent., had a fatal termination. Cochinchina seems to have suffered most, with 1,491 cases (and 887 deaths), including the town of Cholon, where 269 cases and 204 deaths occurred, and Bentré, in which 246 persons were attacked, of whom 170 died. Annam had 470 cases (326 deaths) and Cambodia 262 (178). The seasonal incidence of cholera in Indo-China during 1917 is shown below :—

1917.	Cholera Cases.	Cholera Deaths.
January - - - -	52	29
February - - -	20	12
March - - - -	41	28
April - - - -	166	84
May - - -	1,010	682
June - - -		
July - - - -	522	314
August - - - -	328	182
September - - -	74	37
October - - -	39	20
November - - -	39	32
December - - -	16	6
Total - -	2,307	1,426

The incidence of cholera in Indo-China during the last seven years is shown in the following table :—

Year.	Cholera.		Case Mortality.
	Cases.	Deaths.	Per cent.
1911 - - - - -	6,148	3,883	63·1
1912 - - - - -	16,656	10,560	63·4
1913 - - - - -	432	313	72·4
1914 - - - - -	886	578	65·2
1915 - - - - -	9,894	6,326	63·9
1916 - - - - -	10,775	8,413	78·1
1917 - - - - -	2,307	1,426	61·8
Total in 7 years -	47,098	31,499	66·8

CHINA.

The information available as to the occurrence of cholera in the Chinese Empire during 1914 is extremely scanty. It is at all times difficult to obtain any details as to the incidence of exotic and other epidemic diseases among the Chinese, for there is little or no official supervision of native medical practitioners, who are not required to notify cases of epidemic maladies or to certify the cause of death. The collection of trustworthy statistics in China is, therefore, attended with considerable difficulties. So far as can be gathered from evidence coming from a variety of sources, there were no large epidemics of cholera in China during the year, but at Hong Kong about 23 cases came under observation, and of these 16 died, as compared with 84 fatal cases in 1913. A few cases also occurred in Canton in the early part of the year; in July the presence of cholera was observed at Hankow and Chaochoufu, and in August at Amoy and Kulangsu. Later in the year, namely, in November, the appearance of the disease at Wuchow and at Nanking was reported, but no details were given. There were no cases of cholera at Shanghai during 1914.

The information obtained as to the incidence of cholera in China during 1915 is also meagre; but it is known that at Hongkong about 28 cases were recorded, of which 11 terminated fatally. At Pakhoi, in the month of June, numerous cases of cholera occurred, but no further particulars have been received. It is probable that there was more cholera in China during 1915 than these few facts would seem to show. The disturbed state of China, along with the war in Europe, no doubt helped to prevent the transmission of the required information.

During 1916 cholera was reported to be present at Hongkong, where 10 cases and five deaths were reported. At Canton cholera appeared; and on a ship, the "Taihei Maru," from Hongkong and Chefoo, between 11th and 31st August, there occurred 13 fatal cases. A cholera epidemic is stated to have occurred at Changteh, in the province of Hunan, but no details have been given. Sporadic, or imported, cases were heard of at Shanghai and Dairen (Manchuria).

During 1917 cholera appeared at Antung in November and December, but no details have been received.

It is not to be assumed from the above occurrences that the incidence of cholera in China during the four years 1914 to 1917 has been small, but the few particulars given is the result of the scanty information that has reached this country. It is more than probable that there were far more outbreaks of the disease, especially in the interior of China, which were never reported at all.

MACAO.

On the Portuguese island of Macao, on the south coast of China, 40 miles from Hongkong, and having a population of 75,000, cholera appeared in August, but the Governor of Macao stated officially that the virus was of a mild or "attenuated" type, and that some deaths attributed to cholera were really caused by "gastro-enteritis." A Chinese theatrical company which had been performing at Macao arrived at Hongkong on 13th August, and the same day six members of the company were taken to hospital, and before the 17th four of them died, having apparently brought with them the infection from Macao. Although the Governor of the Portuguese settlement admitted only 15 deaths from cholera, many other deaths occurred with cholera-like symptoms, but were certified under other names.

In March 1917 cholera again appeared at Macao and, up to March, 72 cases had been reported, but the number of deaths was not stated.

JAPAN.

There was but little cholera in Japan during 1914, the only outbreak officially reported being in the Consular district of Nagasaki, at Karutsu and vicinity, at the end of September and beginning of October. Karutsu is a coaling station situated about 50 miles from Nagasaki, and it is surmised that the infection was brought thither from Manila by the s.s. "Hakushin Maru," as the cases occurred solely amongst women in the tea-houses frequented by members of the crew of that ship during the time this vessel was at Karutsu. In addition to that place, cases occurred at Saga, near Nagasaki, and at Kyoto-Fu, but in no large numbers. In all, less than a dozen cases were observed during the year. In 1913 there had been 78 cases and 22 deaths, and in 1912, 2,728 attacks, of which 1,678 proved fatal. The year 1915 appears to have passed without any appearance of cholera in Japan.

In 1916 cholera was epidemic in Japan. Towards the end of July a Japanese vessel arrived at Yokohama from Hongkong *viâ* Manila. After its arrival cases of cholera began to appear on board, 44 persons being attacked among the passengers and crew during the course of a few days. In spite of the precautions taken, the infection spread from the port to the city of Yokohama, where 211 cases and 87 deaths resulted. Subsequently the three prefectures of Kanagwa, Tokyo, and Chiba became affected. In August cholera also appeared in Nagasaki, Kobe, and other places. Altogether 39 prefectures became involved, 10,371 cases with 6,260 deaths being recorded, giving a fatality-rate of

60·3 per cent. The chief prefectures affected were Osaka with 1,592 cases (and 992 deaths): Hyogo, 1,280 (755); Nagasaki, 899 (456); Fukuoka, 675 (425); Hiroshima, 648 (405); Yamaguchi, 636 (380); and Tokyo, 636 (428).

This epidemic was at its height in September; only 120 cases had occurred in Japan up to the end of July. The distribution of the cholera cases and deaths from August to December was as follows* :—

1916.	Cases.	Deaths.
August - - - -	1,305	631
September - - -	5,841	3,238
October - - -	2,567	1,810
November - - -	546	471
December - - -	112	110
Total - -	10,371	6,260

The number of cholera carriers discovered in Japan during 1916 was 3,020. During the cholera prevalence of 1916 in the prefecture of Kanagawa, Dr. Tamezo Kabeshima† investigated the subject of the conveyance of the infection to man by fish. He found the cholera vibrio present in the sea-water off the coast, and also in the intestines and on the surface of fish caught in the infected water. He had been struck by the frequent occurrence of cholera among the local fishermen. He regards the spread of cholera by the handling and by the consumption of such fish as a real danger. To obviate the risks arising from eating fish that have been taken from the sea off the coast where cholera has been appearing, he recommends thorough cooking; steeping the fish in vinegar for four hours is said also to be a useful means of destroying the vibrios.

Cholera was still present in various parts of Japan during 1917, including Osaka, Nagasaki, Shimonoseki, Moji, Fukuoka, Tokyo, and Wakomatsu, but in much reduced amount, the greatest prevalence being in the first three months of the year. The Japanese official Annual Report for 1917 has not yet been published, but, so far as can be learned, the number of recorded cases was 643; the deaths have not yet been reported.

The following table has been compiled largely from the Annual Reports of the Central Sanitary Bureau of the Japanese Imperial Government, and gives the number of cholera cases notified year by year in Japan from 1907 to 1917, the number of recorded deaths from the disease, and the case mortality-rate.

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* These figures are taken from the Annual Report of the Japanese Central Imperial Sanitary Bureau for 1916.

† Le poisson de mer considéré dans ses rapports avec les vibrions cholériques qui peuvent exister dans l'eau. Abstract published in the Bulletin Mensuel de l'Office International d'Hygiène Publique, tome 8, fascicule 8. 1918.

Cholera in Japan 1907 *to* 1917.

Year.	Cases.	Deaths.	Case Mortality.
			Per cent.
1907	3,632	2,526	69·54
1908	652	401	61·50
1909	328	221	67·38
1910	2,849	1,957	68·69
1911	9	4	44·44
1912	2,720	1,683	61·88
1913	78	22	28·21
1914	5	4	[illegible]
1915	—	—	—
1916	10,371	6,260	60·36
1917	643	*	*

Formosa.—Prior to 1916 cholera had apparently been absent for some years from the island of Formosa (or Taiwan), which was ceded to Japan by China in 1895. No cases came under observation in 1914 or 1915, but in November 1916 cholera appeared at two places, namely, Kelung, a port on the north-east of Formosa, and at Taihoku, the capital of the island, some 22 cases and 12 deaths being reported. In February 1917 another small group of cholera cases came under notice at Kelung. The origin of these two outbreaks has not been made public, but were probably due to imported infection.

Corea, which in 1910 became an integral part of the Japanese Empire, had in 1911 a population of about 13 millions. In 1916 an outbreak of cholera occurred in Corea, beginning in August and reaching its height in October. Up to 31st December the attacks amounted to 2,192, the majority being native Coreans; Japanese and foreigners yielded about 300 of the attacks. Many of the cases occurred at Chemulpo, one of the three treaty ports opened by the Coreans in 1883 to foreign commerce, and situated on the west coast of the State. The number of deaths has not yet been officially published. A few cases occurred early in 1917, but on 22nd January Corea was declared free from cholera.

THE PHILIPPINE ISLANDS.

Cholera was prevalent in the Philippines during 1914, and 2,272 cases, with 1,652 deaths, resulted, giving the somewhat high case mortality-rate of 72·7 per cent. In the city of Manila 573 cases and 268 deaths came under observation during the year. Manila is particularly liable to receive cholera infection from ports invaded by the disease in Indo-China, China, Japan, the Dutch East Indies, and other parts of the Far East. In January, 1914, the s.s. "Prinz Sigismund" from New Guinea, on arrival, landed at Manila a passenger suffering from cholera, who died the next day. During the same month the s.s. "Chicago Maru," on arrival at this port, had its passengers submitted to a careful examination and, as a result, a Japanese woman from Kobe was found to be excreting cholera vibrios in her stools. In the second half of 1914, owing to the prevalence of cholera, careful examination was made of the prisoners confined in the Bilibid prison at Manila, and up to 20th November the examination had proved negative; but on that date and within a few days after, 20 carriers of cholera germs were discovered and subsequently a number of others. Examinations of the stools of 1,700 persons employed on river craft, lighters, launches, scows, &c., showed that 19 of them were chronic carriers of cholera infection. The prevalence of cholera in Manila was greatest from July to October, though cases were notified up to the end of the year, as well as during the first quarter of 1915.

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* Figures for 1917 not received.

In the provinces 1,699 cases of cholera were reported during 1914, and of these, 1,384 had a fatal termination.* The three provinces which suffered most were Union, with 497 attacks (and 370 deaths); Capiz, 458 (354); and Bulacan, 323 (227): these three provinces thus contributed together 1,278 of the total cases, and 951 of the deaths from cholera which occurred in the Philippine provinces during the year.

During 1915 cholera again appeared in Manila, and in the first three months of the year 61 persons were attacked, of whom 42 died. Two of the fatal cases arrived at Manila suffering from the disease. In the second quarter of 1915 only a single fatal instance came under observation, and in the third quarter three attacks were reported, of which two terminated fatally, with a single fatal case in the last quarter of 1915. Altogether 66 cases and 46 deaths from cholera occurred in Manila during 1915. In the provinces 1,589 persons were attacked and 774 of them died, giving a case mortality-rate of 49 per cent. The following table shows the incidence of cholera in Manila and in the provinces of the Philippine Islands during the four quarters of 1915:—

Cholera in the Philippine Islands in 1915.

1915.	Manila.		Provinces.		Total in Philippine Islands in 1915.	
	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.
First Quarter	61	42	290	210	347	259
Second ,,	1	1	612	94	613	95
Third ,,	3	2	472	326	475	328
Fourth ,,	1	1	215	144	216	145
Totals	66	46	1,589	774	1,651	827

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* Dr. J. D. Long, Director of Health for the Philippines, in his Annual Report for 1915, published in March, 1916, at page 121, gives the deaths in the Province from cholera during the 1914 as 2,018.

Search was systematically made during the year for the discovery of cholera-vibrio carriers among the natives, and in Manila 32 such persons were found. Similar investigation could not be carried out with the same thoroughness in the provinces, but during 1915 50 such carriers were discovered in the Bilibid Prison at Manila, 47 in the month of January, 1 in February, 1 in August, and 1 in September. Of the provinces, during 1915, the worst sufferers from cholera were Mindanao and Sulu (364 cases), Zamboanga (245 cases), Cotabato (160), and Lanao (144).

During 1916 cholera was epidemic in the Philippine Islands. In Manila 1,214 cases were reported, with 513 deaths; and in the provinces there were 11,633 cases, of which 7,473 terminated fatally, making a grand total of 12,847 attacks, of which 7,986, or 62·1 per cent., died. Of the 1,214 cases in Manila, 206 were reported after death. According to Dr. J. D. Long, the Director of Health, the epidemic of 1916 was essentially a "carrier epidemic," that is, one started by cholera carriers and kept going by them. In his Annual Report for 1916. Dr. Long gives the usual history of an outbreak from a carrier. In a district where no cholera had occurred for some months a person of the poorest class has gone to work, such as fishing, early in the morning and has been exposed to the rain, becoming thoroughly wet all day. On his return home he eats excessively of food which was prepared in the morning and kept all day in a covered vessel; that night he has an attack of purging, cramps, &c., and probably dies next day from his choleraic symptoms. From him the infection generally spreads to those around. It is an ascertained fact that when a cholera carrier is given a purge he often discharges large quantities of cholera vibrios in his stools. It is estimated that in 1916 in Manila alone there were 1,634 cholera carriers among the population. An experience apparently confirmatory of the above occurred at the end of November 1916, when an extraordinary amount of small fish and shrimps were exposed for sale in the market at Manila, and soon showed signs of decomposition, being then sold at greatly reduced prices and bought up freely by the poorer kind of people. Almost immediately cholera began to be reported. Two cases on 28th November and four on the 29th, were followed by 141 others during the next four days. Active measures being taken, the numbers quickly diminished, the total cases for the 12 days during which the outbreak lasted being 215. It is presumed that consumption of the decomposing fish caused the carriers to discharge large amounts of the cholera vibrio, which in one way or another infected those around them. It is explained that the unprecedented catch of the small fishes and shrimps in the bay was due to the invasion of extensive areas of the water by an infusorium, known as peridinium, which either stupefied or killed the fishes in enormous numbers, the fishermen being able to skim them from the surface of the water in basketfuls, some of them having already begun to decompose. Though it was contended by some persons that this was an epidemic of food poisoning, bacteriological investigation showed the presence of the cholera organism in the stools of a number that were examined.

The incidence of cholera in the city of Manila, month by month, during 1916 is shown in the following table :—

1916.	Cases.	Deaths.
January	14	8
February	9	3
March	1	—
April	5	5
May	46	22
June	34	15
July	73	30
August	320	146
September	388	175
October	81	38
November	35	8
December	208	63
Total	1,214	513

The case mortality-rate calculated on these figures was 42·2.

The provinces which suffered most from cholera in 1916 were Iloilo, 2,170 cases (and 1,395 deaths); Negros Occidental, 1,750 (1,069); Ambos Camarines, 1,260 (791); Bulacan, 1,114 (741); and Albay, 908 (501).

The important work of carrying out a cholera carrier survey was continued by the Bureau of Health, to discover the presence of such carriers among the crews of small craft employed in the loading and discharge of the large ships, and also among the crews of the smaller vessels engaged in the inter-island trade. From 1st July 1916 to 30th June 1917, 8,368 specimens of stools were examined and 11 persons were discovered carriers of the cholera vibrio. The Bureau of Science examined the gall-bladder of persons who had died of cholera and demonstrated the presence of the cholera vibrio in 106, and in the intestines in 174.

The cholera prevalence continued in the Philippine provinces during 1917, 12,928 cases and 7,883 deaths being recorded. Only 25 cases and eight deaths from cholera occurred in Manila during the year, making a total of 12,953 cases, 7,891 deaths. Of the provinces, the chief sufferers were Leyte, with 1,434 cases (and 984 deaths); Bohol, with 1,084 (752); Cebu, with 980 (637); and Mindanao, 958 (552).

During the first quarter of 1917, 47 living carriers of the cholera bacillus were found, also a dead person who had been a carrier; and in the second quarter, 28 more living carriers were detected.

The following table shows the incidence of cholera in the Philippine Islands during the last 16 years :—

Year.	Cholera.		Case Mortality.
	Cases.	Deaths.	Per cent.
1902 - - - -	125,560	80,568	64·2
1903 - - - -	40,465	28,746	71·0
1904 - - - -	127	85	66·9
1905 - - - -	1,897	1,418	74·7
1906 - - - -	10,186	7,706	75·6
1907 - - - -	970	743	76·6
1908 - - - -	30,429	19,169	62·9
1909 - - - -	10,144	6,884	67·8
1910 - - - -	9,131	6,634	72·6
1911 - - - -	202	166	82·1
1912 - - - -	—	—	—
1913 - - - -	309	204	66·0
1914 - - - -	2,272	1,652	72·7
1915 - - - -	1,651	827	49·0
1916 - - - -	12,847	7,986	54·4
1917 - - - -	12,953	7,891	61·0
Totals - -	259,143	170,679	65·5

THE HAWAIIAN ISLANDS.

No cholera, so far as is known, occurred in the Hawaiian Islands during 1914. Owing to the large number of Filipino labourers who leave the Philippines for Honolulu to seek employment, and in view of the prevalence of cholera in Manila at the end of 1913, the authorities instituted, in December of that year, a search for carriers among the passengers arriving from the Philippines. Out of 1,242 persons examined between December 1913 and June 1914, two carriers of the cholera bacillus were discovered among the Filipino labourers landed at Honolulu, but subsequently no attacks were reported; nor was anything heard of cholera in the Hawaiian Islands during 1915, 1916, or 1917.

THE BRITISH ISLES.

No cholera cases occurred in the British Isles during 1914, 1915, 1916, or 1917, but several vessels technically classed as "suspected" arrived in English ports during that period.

1. The s.s. "Peleus" arrived at Liverpool on 14th September 1914 from Yokohama, from which she sailed on 18th June, calling at Macassar, in the Island of Celebes, Dutch East Indies, on 30th June, and remaining there till 9th July. Cholera was prevalent in Macassar at the time. A quartermaster of the "Peleus" fell ill of the disease on 8th July, and died on board the ship the same night. He had been bathing in the harbour and his illness was attributed to infection from the polluted water of the harbour in which he had bathed. All the usual

precautions were taken and no further cases occurred. On arrival at Liverpool all on board, numbering 66 persons, were medically examined and found in good health.

2. The s.s. " Atreus " left Kobe, Japan, on 11th November 1914 and reached Liverpool on 18th January 1915. She had called at several ports, including Hongkong and Saigon, the latter on 5th December, and at Singapore on 11th December. A member of the crew fell ill of cholera on 10th December, and died on the 11th, the day of arrival at Singapore, where the body was buried and all the routine measures carried out. There were no other cases, and when the ship reached Liverpool, the 79 persons on board were found, on inspection, to be well.

3. The s.s. " Knowsley Hall " sailed from Calcutta for London on 10th November 1915, reaching Colombo, Ceylon, on 17th November, where a fireman was landed suffering from symptoms of cholera. The crews' quarters were disinfected, the bilges pumped out, and the water tanks cleansed and refilled, and the vessel resumed her voyage. On arrival in the Thames all on board, numbering 71, were found in good health after medical inspection.

4. The s.s. " Assyria " from Calcutta arrived at Gravesend on 20th July 1916 and reported that nine days after her departure from Calcutta, and while in the port of Colombo, one of the crew was attacked by cholera, of which he died, the diagnosis being bacteriologically confirmed. After the usual precautions had been taken the ship continued her voyage, and no further cases occurred. Medical inspection at Gravesend on her arrival proved that the 92 persons on board were in good health.

5. The s.s. " Mombasa " left Calcutta on 17th July 1916 and arrived at Madras on the 23rd, on which day two members of the crew were attacked by cholera. They were taken on shore to hospital, where one of them died. The vessel was disinfected and went on to Colombo, where another suspected case was landed; but after this no other persons were attacked. On arrival at Gravesend on 6th September she had 127 persons on board, all being found well on medical inspection. This ship had been again disinfected at Marseilles before leaving for England.

6. The s.s. " Glodale " left Basra on 12th October and arrived at Gravesend on 13th December 1916. While at Basra a British fireman suffered from choleraic symptoms and was taken to hospital as a suspected case of cholera. The ship sailed, leaving him behind, and no other persons on board were attacked. At Basra the crew drank boiled river water, but it is said that the man attacked had drunk the water unboiled. All on board were found to be well on arrival in the Thames.

BELGIUM.

During November 1914, some of the London newspapers published a statement to the effect that cholera had broken out among the refugees at Antwerp and that 20 cases had been reported. But, so far as can be ascertained, there has been no official confirmation of the report.

FRANCE.

A few cases of cholera occurred early in 1916 at Marseilles among the Serbian refugees brought to that port from Albania. The disease had been prevalent in Serbia, Austrian prisoners having infected the Serbians early in the war. Although undoubtedly cholera, the disease did not, in all cases, present the classic symptoms, and was at first regarded as " entérite de misère," but subsequently bacteriological investigation showed the presence of typical cholera-vibrios in the stools of the patients. So far as is known, the infection did not spread to the inhabitants of Marseilles, but was confined to the Serbian refugees. On a ship conveying Serbian soldiers to Marseilles from Albania three of the crew were attacked by cholera on the voyage; none of them had been inoculated.

GERMANY.

After cholera had established itself in the late autumn of 1914 in Austria the infection spread thence to Germany, the majority of the cases being reported in Prussian Silesia, which lies close to the frontiers of Austria and Russia, during the month of November. Those who were first attacked had come from Austria, and included soldiers, prisoners of war, and civilians who had been employed by the military as transport drivers and in other capacities. Up to mid-December from the beginning of November 1914 about 60 cholera cases were notified in Prussian Silesia; a few cases were also notified in the provinces of Posen and Brandenburg. No report has been issued by the German authorities as to the number of prisoners of war who were attacked by cholera in 1914.

Cholera was more prevalent in Germany during 1915, more particularly in the camps in which the prisoners of war were interned. Altogether 1,161 cases and 194 deaths from cholera were reported during the year. Of these, 88 attacks and 12 deaths occurred among German soldiers, while 1,073 cases, of which 182, or nearly 17 per cent., were fatal, occurred among prisoners of war, especially in the districts of Oppeln, Breslau, Marienwerder, and Bromberg. The prevalence lasted from March to November, but was at its worst during August, in which month 829 cases were reported, 753 being prisoners of war, 65 German soldiers, and 11 civilians. The prisoners' camps in which the largest numbers of cholera cases occurred during 1915 were Hammerstein and Czersk, both situated in the province of West Prussia and in the administrative district of Marienwerder; also the camp at Bütow, in the Prussian province of Pomerania, situated in the administrative district of Köslin. In August, 454 cases were reported in the prisoners' camp at Hammerstein, 108 at Czersk, and 119 at Bütow. The German troops guarding the prisoners' camps appear to have been protected against cholera infection by inoculation, but this means of prophylaxis was not extended to the unfortunate prisoners of war. It is not difficult to understand how easily cholera could spread under the existing insanitary conditions in the incarceration camps. There is practically no information available as to the incidence of cholera in Germany during 1916, except that a fatal case was reported in the town of Hanover at the end of August. How many non-fatal cases occurred has not been stated. All that has been heard of cholera in Germany during 1917 is that in January seven prisoners of war were attacked by cholera, of whom only one died, in the administrative district of Marienwerder in the province of West Prussia, where the disease had been very prevalent in 1915 among the prisoners of war in certain camps.

Owing to difficulties of obtaining trustworthy information from Germany during the war, and in view of the policy of the authorities in that country to conceal as far as possible from other nations what is going on in Germany, it cannot be said that the above slight outline of the incidence of cholera in that Empire represents all that has occurred during the past four years, *i.e.*, to the end of 1917.

AUSTRIA-HUNGARY.

In September 1914 cholera appeared in Austria in the war zone, the early cases being Russian prisoners of war and Austrian soldiers sent back from the fighting lines. From the prisoners the infection spread to their guards, and ultimately reached the civil population. Owing to the war conditions and the suppression of the usual channels of information, as well as owing to the unwillingness of the Austrian officials to give information to the enemy, the figures relating to cholera in Austria during 1914 are incomplete. From various sources, chiefly American, it has been ascertained that the officially admitted number of attacks during the period September to December 1914 was 3,467, and of these, 937 had a fatal termination, giving a case mortality-rate of only 27 per cent. Other information suggests that this is an underestimate of the ravages of the disease. *The Times*, of 19th October, published a communication from its special correspondent at Rome to the effect that "10,000 cases had been reported in Austria-Hungary in a single day," and that there was a high percentage of rapid deaths; it is added that "the official communiqués mention but few cases." At the beginning of November a statement appeared in the *Wiener Klinische Wochenschrift* that cholera had by that time spread over more than 100 localities in Austria-Hungary, and that in October the estimated number of cases which occurred in that month was 2,000, "not including attacks among soldiers at the front." Of the total cases 506 were reported in the province of Lower Austria, and of these, 406 were referred to Vienna. But the largest number of attacks occurred in Galicia, where 2,088 cases were recorded, with 375 in Moravia, 349 in Austrian Silesia, 179 in Bohemia, 67 in Styria, and 45 in Carinthia. A few cases also occurred in the provinces of Upper Austria, Carniola, Salzburg, Tyrol, and Vorarlberg.

In Hungary, during 1914, 3,181 persons were attacked by cholera, but the number of deaths from the disease has not yet been reported. In the city of Budapest 346 cases occurred, and 697 others in the adjoining districts.

In Croatia-Slavonia, the official returns quoted by neutral journals give 323 attacks by cholera during 1914; and in Bosnia-Herzegovina the disease is said to have been present, but not in any great amount. No precise figures have been given as to cases and deaths in Bosnia and Herzegovina during 1914.

Altogether there were during 1914 in the Austrian Empire (excluding Bosnia and Herzegovina, for which definite figures are not yet available) 6,971 reported cases of cholera; but this is probably below the actual amount that really occurred.

During 1915 cholera became epidemic in the Austrian Empire, and so far as published reports can be relied upon there were altogether 41,454 cases and 21,751 deaths, giving a case mortality-rate of 52·5 per cent. The distribution of these cases and deaths was as follows :—

Country.	Cholera.		Case Mortality.
	Cases.	Deaths.	Per cent.
Austria	32,348	17,252	53·3
Hungary	5,527	3,034	54·9
Croatia-Slavonia	2,723	1,158	42·5
Bosnia and Herzegovina	856	307	35·8
Austrian Empire	41,454	21,751	52·5

In Austria itself, 1,241 cases occurred among prisoners of war, 840 among the troops, the remaining 30,267 cases occurring among the civil population. The Austrian province which suffered by far the most from cholera was Galicia, in which, during 1915, no fewer than 30,131 (out of the total 32,348) cases, and 17,213 (out of the total 17,252) deaths were recorded, giving a case mortality-rate of 56 per cent. The reason why Galicia suffered so much was owing to the fact that it was in the war zone, and that the conditions in the province were very favourable to the spread of the infection. There were 650 cases in Austrian Silesia, 301 in Lower Austria (of which 77 occurred in Vienna), 289 in Küstenland, 218 in Carniola, 159 in Bohemia, 127 in Styria, and 126 in Moravia, the remaining cases being distributed over six other provinces. The height of the epidemic was experienced in the hot months of the year, July, August, and September. Precautions were specially taken to protect the Austro-Hungarian troops assembled in the Eastern war zone, and anti-cholera inoculations were employed. On trustworthy authority, it is stated that this measure was of considerable service in protecting the military against cholera infection. Some soldiers who definitely refused to be inoculated contracted cholera, of which many of them died, among them being General von Ziegler, commanding one of the Army Corps in Galicia. He was, it is asserted, the only officer of the staff of this Army Corps who refused inoculation, and he was the only one who died of the disease. Of the 5,527 persons attacked during 1915 in Hungary, 419 were prisoners of war, and 298 were Hungarian soldiers.

During 1916 the cholera prevalence in Austria gradually subsided, though in the first quarter of the year 153 cases and 57 deaths were reported, mostly in the month of January. The majority of the persons attacked were in the province of Moravia, where they numbered 124 with 47 deaths, Galicia having only 11 cases; Dalmatia, 6; Lower Austria and Upper Austria had each five reported attacks, while Bohemia had only two. So far as can be ascertained, only a single case of cholera occurred in Vienna during 1916. There was a similar decrease in the incidence of cholera in Hungary in 1916, for only 13 cases and eight deaths were officially reported. In Croatia-Slavonia 274 cases with 232 deaths were reported. In Bosnia and Herzegovina there were 470 cholera attacks, of which 147, or 31·3 per cent., proved fatal; of these cases and deaths no fewer than 438 and 139 respectively occurred in a prisoners of war camp at Doboj (in Bosnia) in a period of about six weeks, 8th April to 20th May. So far as can be ascertained, and adding the above figures together, there were, in all, 910 recorded cases of cholera in the Austrian Empire during 1916, and 444 deaths, giving a case mortality-rate of 48·6 per cent. So far as is known there was no reported cholera in the Austrian Empire during 1917.

RUSSIA.

Cholera was present during 1914 in southern and western Russia, in the Governments of Kherson, Kieff, and Podolia, and some cases were also reported in the cities of Moscow and Warsaw. The disease appeared in Kherson in July, and in the same month in Podolia; it was, however, in this last-named Government that cholera was most active, attacking, between 10th July and 2nd August, as many as 303 persons, of whom 105, or 34·6 per cent., died. The districts in Podolia which suffered most were Vinnitza and Yampol: these are situated close to the Austrian frontier, and it is very probable that the epidemic of cholera in Austria, which began in September 1914, was due to infection carried by Russian soldiers into the province of Galicia from the Podolian districts of Vinnitza and Yampol, in which cholera was still occurring in 1915. The disease appeared in the city of Moscow in November 1914, and cases were also reported in Warsaw city during the same month, as also up to February 1915.

During the year 1915 cholera was again present in Moscow, where, from January to November, 731 cases and 257 deaths were recorded, giving a fatality-rate of 35·1 per cent. A Reuter's telegram published in a London newspaper of 22nd August 1915, mentioned that cholera was said to be prevalent at the time in Riga and at Petrograd, as well as at Kovno, which is south of Riga, but no particulars were supplied. During October several cases of cholera were observed in Archangel, and in the autumn months the disease was present in southern Russia at the ports of Kherson and Odessa, as also at Theodosia, or Kaffa, a commercial port on the eastern side of the Crimea. Sporadic cases were also observed at Romanovsk, in the Government of Kuban, at Stavrapol, Georgievsk, Kislovodsk, Mariupol, Batoum, and Poti. In the Caucasus cholera appeared during August 1915 in the Government and port of Baku, and in September at Tiflis, the chief city and capital of Caucasia; other cases being reported south of Tiflis, among the refugees from Asia Minor. About three-fourths of the cases were civilians and the remainder military. In Northern Caucasia and in Trans-Caucasia there was a wide-spread prevalence of a disease suspected to be cholera of a modified kind and characterised mainly by nausea, vomiting, and diarrhœa.

From a semi-official source it is stated that cholera was present during 1915 in 40 Russian provinces, the combined population of which was about 96 millions. It began to be more prevalent in June and declined towards November. Approximately 15,500 cases of cholera were reported during that period. It is also alleged that the diffusion of the disease was not due to contamination of drinking water, but to "carriers" and direct infection.

In 1916 cholera reappeared in Caucasia during August at Tiflis, both in the city and in the surrounding districts. Special isolation hospitals were erected at Tiflis, Avatchala, and Gori for cholera cases; the sale of fruit at railway stations was forbidden, and only boiled water was allowed for travellers to drink. Later, communications from a neutral country reported in December that Petrograd and Podolia were considered to be at that time infected by cholera, but no details were given.

Owing to the war and to the revolutionary disturbances in Russia during 1917 little information has been obtainable as regards the incidence of cholera in that unhappy country during the year. All that is known is that a neutral Government officially declared in February 1917 that the city and Government district of Petrograd and the Government district of Podolia were "infected by cholera," but, as before, no particulars were furnished.

ROUMANIA.

A telegram sent from Galatz to this country by the British Consul-General stated, on 9th November 1916, that cholera had broken out at Galatz, Braila (or Brahilov), and Toulchea, but no details have been received as to the number of cases and deaths, nor as to the origin of the outbreak: but in *The Times* of 13th October 1916 a wireless press telegram from Petrograd was published to the effect that an enemy air squadron dropped bombs on Constanza, also "sweets and garlic infected with cholera bacilli." The only other evidence, if it can be so called, in support of this telegram, is the fact that soon after the alleged dropping of cholera-infected material, cholera broke out in Roumania, though not at Constanza or Kustendji, a port in the Debrudja, the place at which the dropping is said to have occurred. The nearest place where cholera occurred was Toulchea or Tuldja, which is 70 miles, as the crow flies, from Constanza. What truth there may be in the alleged conveyance of cholera to Roumania by the aeroplane* of the Central Empires it is not easy to say. There was no mention of cholera in Roumania during 1917.

BULGARIA.

The *Bulletin of the Office International d'Hygiène Publique* states that cholera appeared in July 1914 at two place in Bulgaria, the first being Tatarbazardik on the Maritsa River, about 37 kilometres from Philippopolis, and the second, Gumuldijk, which lies some distance further to the south. No information has been given as to the source of the infection in these cases, or if there was any extension of the disease from them. But as Tatarbazardik is on the main railway line from Constantinople northwards through Bulgaria it is probable that the infection was conveyed from Turkey, where the disease had been appearing in a number of places before this time.

Nothing was heard as to cholera in Bulgaria during 1915 except that the Italian *Bolletino Sanitario* mentioned the occurrence of five cases in February at Rustchuk, a Bulgarian town and port on the south bank of the Danube, 14 miles by rail north-west of Varna.

SERBIA.

An epidemic of what was at first regarded as diarrhœa occurred in 1914 among the Serbian troops as well as the civilian population. At a later stage bacteriological investigation established that cholera was the current malady. The majority of the reported cases were of a mild type. According to a description of the epidemic given by Dr. Petrovitch in the *Bulletin de l'Académie de Médecine* for August 1915, of 1,153 cases of a mild character none were fatal; another class of cases was of a moderate severity and the fatality-rate among them 9·4 per cent., while another set, comprising 277 cases, was of a severe kind and had a case mortality-rate of 58 per cent. Dr. Petrovitch claimed considerable success in the treatment of his cholera patients by bacteriotherapy. It is said that in 1914 the infection was spread in Serbia by Austrian prisoners, but the strain of the virus, upon the whole, was comparatively mild.

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* In this connection it may be remembered that in 1917 a rumour was spread in the British Isles that the Germans were going to introduce plague by means of aeroplanes and submarines. It was said that artificially infected rats would be let loose on the coast of England, and by inducing an epizootic bring about a "frightful" epidemic of plague amongst the human population.

During 1915 a few cholera cases were reported in Serbia in June and July, but details have not been forthcoming. Large numbers of Serbian soldiers and refugees who retreated to the Albanian coast were sent by the Allies by ship to various places to rest and recruit their strength after the sufferings and privations experienced during the retreat from Serbia to the Adriatic coast. Many of them were sent on transports to Marseilles, and others to Biserta (Tunis) and other North African ports, some of them dying on the voyage and others conveying the infection into Biserta and other places.

There is no information available regarding the incidence of cholera in Serbia during 1916 and 1917.

GREECE.

Though cholera had been prevalent in a number of localities in Greece during 1913, there was no marked incidence of the disease in 1914 in that country. Some scattered cases only were reported, of which a few occurred at Salonica in September. In October the infection was carried from the Gallipoli peninsula to Piræus, but did not spread. Cases were also observed at Janina and one or two other places. So far as can be learned, there were no cholera outbreaks in Greece during 1915; but early in 1916 the disease broke out among the retreating Serbian soldiers and refugees who had been conveyed to Corfu from Albania. From the Serbians the infection spread to the civil population of the island of Corfu, but no figures are available as to the extent of this latter prevalence, except that out of 13,467 Serbians in the island, 325 had been attacked by cholera, of whom 187, or 57·5 per cent., died.

In July 1916, 15 cases and eight deaths from cholera were reported at Moschopolis in North Epirus, and 23 others, with eight deaths, at Koritza (or Gortcha), a town not far from Moschopolis; but no further details have been given of these occurrences.

ITALY.

In August 1915 some sporadic cases of cholera among prisoners of war and soldiers from the front occurred at Leghorn and Venice. In September the disease broke out among a batch of Austrian prisoners of war interned at Monreale, about 4 miles from Palermo, in the island of Sicily. A bacteriological investigation was instituted and resulted in the finding of 15 cholera "carriers" among the prisoners of war. In August the Italian Government made anti-cholera inoculation compulsory in the army and navy.

More recently it has been stated that Italian troops, after capturing trenches on the Isonzo front, have occasionally found in them Austrian soldiers suffering from cholera. As a result, the disease was conveyed into the interior of Italy during 1915, but at no place, as has already been stated, did more than a few cases occur, except at Reggio d'Emilia, in Northern Italy, where 100 persons were attacked in a lunatic asylum which was being used temporarily as a military hospital. Only about 27 per cent. of those attacked died.

The Italian Government sent 20,000 Austrian prisoners of war in 1915 from Albania to the uninhabited island of Asinara, off the north-west coast of Sardinia. On the voyage 6,000 deaths took place. It was at first concluded that this mortality had been caused by dysentery, but bacteriological examination demonstrated that the disease was cholera, and that a large proportion, if not all, of the 6,000 deaths had been therefore due to cholera infection. All those attacked on the transports had been in the incubation stage when they embarked. It was said that these prisoners had all been previously inoculated against cholera, but it was believed that misery, starvation, fatigue, with physical and moral distress, had overcome the acquired immunity and made them susceptible to the infection. On the other hand, no cases occurred among the crews of the transports, all of whom had been inoculated against cholera. Among a batch of 400 of the Austrian prisoners disembarked at Asinara, 62 carriers of the cholera bacillus were discovered through examination of their stools.

During the month of July 1916 there was a cholera outbreak among the Italian troops on the Lower Isonzo, but it was suppressed in a few days; no further details, however, have been obtained as to the number of cases and deaths or as to the source of the infection.

TUNIS.

As has already been mentioned, while dealing with the incidence of cholera in Serbia and Greece, the disease was carried on shipboard from Corfu and from Albanian ports to Biserta, in Tunis, and other ports in North Africa. The hospital ship "Brasili," for example, conveying Serbian soldiers from Valona to Biserta, had 17 cholera deaths during the voyage; and the "Ré d'Italia," with 1,107 invalids from Valona to Biserta, had 116 deaths from cholera on the passage. Another ship, the s.s. "Albaro," carrying Serbians from the port of Durazzo to Biserta, had 149 cholera cases and 47 deaths during the three days which the voyage occupies from the Adriatic to Tunis. The same ship on a subsequent passage had 23 cases and seven deaths. The French troops in North Africa had previously been protected by anti-cholera inoculation, and none suffered from the disease after its introduction into Tunis by the Serbians.

EGYPT AND THE SOUDAN.

During April 1914 two isolated cases of cholera occurred at Omdurman on the Nile, opposite Khartoum. The diagnosis appears to have been confirmed bacteriologically. The patients were two native soldiers belonging to a Soudanese regiment, and had been members of the garrison of Omdurman since 1912. The first case was fatal and the second recovered: the infection of the latter had been received from his comrade, with whom he had habitually had his meals. In the absence of any known source of infection from which these men could have derived their illness it was surmised that the soldier who was first attacked had been a chronic carrier of the cholera vibrio; that he had acquired his latent infection at some previous date, and that accidental circumstances had led to his developing in his own person an attack of cholera and enabling him to infect his fellow soldier. There were no other cases of cholera at Omdurman during 1914; nor did any case occur in Egypt or the Soudan in 1915. According to the fourth quarterly return of deaths in the governorates and provinces of Egypt for 1916 there was one death from cholera in Egypt. But during the year there were some ship-borne cases at Suez in two transports bringing Annamite coolies from Indo-China to France to work behind the lines in the Western battle zone. The first of these vessels was the French s.s. "Pei-ho," for Marseilles, which arrived at Suez on 18th May 1916 with a crew of 70 and 2,285 coolie passengers. The ship left the port of Saigon (Cochinchina) on 19th April, reaching Colombo on 30th April, landing the corpse there of a man who had died of cholera just before arrival in port. The usual precautions were observed, but after leaving Colombo eight other cholera cases occurred between 1st May and 17th, all fatal. On arriving at Suez, medical inspection detected five other cases suspicious of cholera, two of whom died. The ordinary precautions were taken, and the ship was sent, on 21st May, to the El Tor quarantine station to undergo the prescribed period of observation of those on board. During this period 41 cases of cholera developed among the coolie passengers, and later a number of fresh cases were reported. Altogether there were 136 cases of cholera and 66 deaths in connection with the s.s. "Pei-ho" from leaving Saigon up to the end of the period of observation at El Tor. Investigation of the bowel discharges of the rest of the Annamite coolies, while under observation, demonstrated that 44 of them were chronic carriers of the cholera vibrio.

The second vessel was the s.s. "Hong Kong," an English-owned ship. It left the port of Haiphong (Tonkin) on 27th April, and called at Colombo on 9th May, *en route* for Marseilles, with a crew of 75, and 2,653 Annamite coolies; there were also 27 Europeans on board. Between Haiphong and Colombo 17 cholera cases occurred, 14 of which were fatal. On arrival, there were three surviving cases on board, and during the stay of the vessel 38 other cases were landed, of whom 25 died. The ship reached Suez on 15th June and reported that altogether, since sailing from Haiphong, 55 cases of cholera had occurred on board and that 33 had terminated fatally. The "Hong Kong" was sent to the El Tor station to undergo observation for the prescribed period, but no further cases were reported. In consideration of the grave danger that might arise from the presence of other undetected carriers of cholera among the coolies on the "Pei-ho" and the possibility of the introduction of the infection into France, the French Government abandoned the idea of employing these Annamite labourers behind the lines on the Western front, and the vessel, with all on board, was sent back to Saigon. It may be added that cholera was prevalent in Indo-China at the time the coolies were embarked for Europe, but they had undergone detention at a lazaret at Saigon for 20 days before sailing. The case of the s.s. "Hong Kong" was not regarded as being so serious; after all due precautions had been taken the ship was allowed to pass through the Suez Canal for Marseilles on 18th June.

In June 1917 some cases of cholera and suspected cholera were reported in Egypt among soldiers coming from the Palestine war-area. Some of these cases were confirmed by bacteriological examination. One case, described as para-cholera, occurred at Suez, the patient being a Turkish prisoner of war. There was apparently no extension of the cholera infection in any of the above cases. In November three cases of the disease were discovered at Akaba, at the head of the gulf of that name, an arm of the Red Sea. These cases comprised a Turkish prisoner, a desert Bedouin, and a travelling merchant. During November, on the s.s. "Hardinge" from Akaba to Suez, a cholera case was discovered, the diagnosis being bacterioscopically confirmed. In December, five fresh cases were reported among native Egyptians employed in the labour and transport corps by the British military authorities, and who had returned from the Palestine front.

In January 1918 two transports, the s.s. "Szechuen" and the s.s. "Kalzar," arrived at Port Said from the coast of Palestine; in the first ship, 25 Egyptian Labour Corps men, and in the second, 15, came home on the sick list and were detained under observation; 10 were carefully examined to detect the presence of cholera, and six of them were found positive, five of them dying subsequently, four of which were certified as from cholera. Among another batch of 29 returned Egyptian labourers, cholera vibrios were found in the stool of 5 of them. They had all come from places in Palestine behind the fighting line. It may be mentioned that 64 cholera cases were notified about this time (January 1918) in the south of Palestine, only one of which was a soldier; and in the first week of February 12 fresh cases were reported.

FRENCH SOMALILAND.

In April 1916 the occurrence of cholera was officially reported at Djibutil, or Jiboutil, the chief port of French Somaliland; but no details of this occurrence have been obtained, except a confirmation of the report by H.M. Legation at Addis Abata, Abyssinia.

TURKEY.

Cholera was prevalent in Constantinople at the end of 1913, and it continued to occur up to July 1914, though not in any great amount, only 32 cases and 17 deaths being officially reported. After that the disease was present in the city up to October, but no figures are available from official sources to show the extent of this autumnal prevalence. Cases also occurred in the suburbs at Pera and Galata. In the villayet and in the city of Adrianople cholera was present among the troops, and, in the latter caused 110 attacks with 94 deaths. The disease appeared at Kirk Kilisse and Tchataldja during the spring and summer months of 1914. Among the large numbers of Turkish troops encamped in the Gallipoli peninsula and along the Asiatic shores of the Dardanelles cholera appeared in 1914 in January and persisted up to May, recurring again later in the year. The places in this region invaded by cholera included the town of Rodosto on the shores of the Sea of Marmora, 60 miles from Constantinople, Kaleh Soultanieh (or Tschanak), on the Asiatic side of the Dardanelles, and Tchamlidja in Asia Minor, on the heights overlooking the Bosphorus. On the north coast of Asia Minor cholera appeared at the Black Sea ports of Eregli and Trebizond, as also in the interior at Eski-Shehir and elsewhere. In the early part of the year cholera was appearing at Smyrna and at Beirut. For various reasons the details of the cholera occurrences in the Turkish Empire during 1914 have been concealed by the authorities from the local public as well as from the outer world, so that it is not possible to give here any figures showing the number of cases and deaths, or the sources of infection and methods of spread. It is known, however, that the appearance of the disease was associated with the movements of the Turkish troops, from whom the infection often extended in places to the civil population. On the island of Kamaran, situated in the Red Sea and used as a quarantine station for pilgrims from the Far East travelling to the Hedjaz, cholera cases were landed from two pilgrim ships, namely, the s.s. " Yelunga " in September, and the s.s. " Bahrein " in October, both vessels coming from the port of Bombay. From these two ships five cases were landed, and four of them terminated fatally.

During 1915, owing to the war, little information could be obtained as to the incidence of cholera in Turkey, but from an American source it was reported that, towards the end of December, there was an outbreak at Trebizond on the southern shore of the Black Sea, and that in three days 15 cases and 10 deaths were recorded. It is more than probable that there were other outbreaks. Reports on epidemics are at all times difficult to obtain from Turkey, and since the war began this difficulty has been increased.

From various sources information was received that cholera was widely prevalent in all parts of Turkey during 1916, and it appears, from an article published by Surgeon-Major E. Rist, of the French Scientific Mission, that 13,836 cases occurred, of which 7,159, or 51·7 per cent., proved fatal. The majority of the attacks were referred to Turkey in Asia, but there was an outbreak in Constantinople, where 209 cases and 92 deaths were recorded; about 20 cases occurred in Gallipoli, and at Panderma, near Rodosto on the Sea of Marmora, 177 cases with 51 deaths were reported from May to July. The local figures given here are probably far below the actual numbers of cases and deaths. Many places along the Black Sea coast of Asia Minor were involved, including Trebizond, 64 cases (and 17 deaths); Samsoun, 69 (29); Ordu, 167 (87); and Urfu, 97 (57). The disease was epidemic during the summer months in other ports on the west and south of Asia Minor, including Smyrna, 237 cases (and 141 deaths); Adalia, 73 (the number of deaths has not been given): Tarsous, 31: Adana, 150 (79). In the interior of Asia Minor cholera was also epidemic from May to July, Aleppo having 340 cases (and 163 deaths): Aiden, 389 (181): Marash, 456 (156); Sivas, 82 (30); Aintab, 381 (237); and Erzerum (the number of cases and deaths has not been reported). In Syria cholera was severely epidemic during 1916 in the summer months. Jerusalem had 343 cases (and 209 deaths); Bethlehem, 159 (94); Hebron, 443 (245): Jaffa, 222 (97): Damascus, 426 (314); Beirut, 51 (25); and Tripoli de Syria, 219 (71). Mesopotamia also suffered during 1916, and at Bagdad 126 cases and 37 deaths were reported and Geseh, 209 (161). Cases also occurred at Basra and elsewhere, but no figures are available to show the extent of the cholera incidence there. The disease affected the troops in various parts of Turkey as well as the civil population.

The prevalence of cholera continued during 1917, though not so severely as in the previous year. At the time of writing the returns of cases and deaths are incomplete. In Mesopotamia the disease was epidemic in the town of Mosul, on the Tigris River, 200 miles north of Bagdad, 472 cases being reported with 97 deaths. The prevalence of the disease was continued in some of the towns of Asia Minor, Aleppo having 156 cases (and 75 deaths); Konia, 59 (35); Sivas, 98 cases (the deaths have not been stated); Diabekir had 79 cases and 24 deaths; Adana, 115 (44); Ordu, 91 (41); Samsoun, 23 (8); and Izmid on the Sea of Marmora, 30 (14). Syria also suffered from the continued prevalence of cholera, Damascus having 96 cases (and 35 deaths); Jerusalem, 47 (15); and Tiberias, 39 (18). Beirut had only 17 cases and 12 deaths, while in the Lebanon district 19 cases and 8 deaths were recorded. So far as can be learned there were only 29 cases and 19 deaths in Constantinople; the presence of cholera was reported at Rodosto, 60 miles from Constantinople, on the shores of the Sea of Marmora. As has been said the returns that have reached this country are incomplete, and probably fall far short of reality. Up to 29th October, 1,777 cases of cholera were reported in Turkey, with 606 deaths. In connection with the cholera prevalence in Mesopotamia during the autumn of 1917, it is of melancholy interest to mention that one of the victims to this disease was General Sir Stanley Maud, commanding the British forces in Mesopotamia, who died at Bagdad of cholera on 18th November. There had been already 40 deaths from cholera in Bagdad in the fortnight preceding the death of General Maud.

At the beginning of 1918 cholera was occurring along the borders of Egypt and Palestine and north of El Arish. Cases were reported at Jaffa, Jerusalem, Sukarieh, Ramleh, Esdud, and Seneid. Up to 24th February, about 122 persons had been attacked by cholera, but the number of deaths has not yet been published.

PERSIA.

Beyond the bare fact that a single case of cholera was reported in June at Enseli, on the southern shores of the Caspian Sea, nothing was heard of the disease in Persia during 1914. As the country was in a very disturbed condition owing to rebellion of some of the people, and to invasion by Turkish troops, it is possible that the ordinary channels of communication were closed, and the transmission of information prevented. It is therefore possible that there may have been outbreaks of cholera during 1914 of which no record has been kept.

In the summer and autumn months of 1915 cholera was somewhat widely diffused in the northern provinces of Persia, especially in Azerbijan (or Aderbaijan), of which Tabriz is the capital; in Ghilan, which lies between the Elburz range of mountains and the Caspian Sea, of which Recht (or Rasht), is the capital; and in Kazvine (or Casbin), the capital of which is the town of Kazvine. The first cases which attracted attention occurred during August in the Azerbijan province at Tabriz (or Tauris), and were apparently connected with previous cases which had been observed at Djoulfa (or Julfa), a place situated just over the Russian frontier in the Trans-Caucasian province of Erivan, where cholera had been appearing among the troops quartered there. It is alleged, on the other hand, that the Russian soldiers contracted cholera at Tabriz and carried it back with them to Djoulfa. In Tabriz, which has a population of about 170,000, there were recorded, from August to October 1915, some 245 cases, with 202 deaths. Other places invaded by cholera during the year in the Azerbijan province were Alandar, Astara, Gazian, Khoï, Maraghe, and Ardobil. The chief places attacked by cholera in the Ghilan province were Recht and Enseli, a port on the southern shores of the Caspian Sea, about 18 miles from Recht. In the province of Kazvine, the places known to be invaded by cholera during the year were Mendjil and the town of Kazvine. The height of the cholera prevalence of 1915 in Persia was reached in September, after which the incidence declined; but at the end of the year cases were still occurring in Essalime, Enseli, Gazian, Recht, Kazvine, and other places. At a meeting of the Teheran International Sanitary Council early in December it was mentioned that cholera had been occurring recently among the Russian troops operating in Northern Persia. As has been said, the disturbed internal condition of the country has interfered with the transmission of reports concerning cholera and other diseases; so that it is not possible to give any approximation to the total number of cases and deaths which occurred from cholera in Persia during 1915.

In February 1916 cholera was still persisting in the Ghilan province, especially at Enseli and Recht. In the former, 74 cases with 37 deaths were recorded up to September, and in Recht up to October, 165 cases with 86 deaths. A considerable outbreak occurred in Teheran itself, comprising 492 attacks, of which 447 were reported to have terminated fatally. Cholera continued to be prevalent in the town of Kazvine, where 113 cases and 70 deaths were recorded. At Mohammerah, a port in the province of Arabistan, on the River Karun, and near the Turkish frontier, there were 52 cases and 17 deaths during June and July. At Shah Abdul Abim, near Teheran, an outbreak occurred comprising 65 cases and 40 deaths. Other smaller outbreaks were reported at a number of places, the total, including those mentioned above, amounting to 1,072 cases, of which 755, or 70·4 per cent., proved fatal. These figures are probably far from showing the extent of the cholera incidence in Persia during 1916.

In 1917 outbreaks continued to occur in the province of Khorassan, Chahmirazed, Astarabad, and Mazanderan. The most serious of these outbreaks was at Sari, the capital of the province of Mazanderan, situated about 18 miles south of the Caspian Sea, having a population of about 8,000. Here, during July and August, 549 cases and 339 deaths from cholera were reported. At Makon, in the province of Azerbaijan, 174 persons were attacked by cholera during August and September, and 82 of them died. At Torogh, in the province of Khorassan, 123 cases and 25 deaths came under observation. In addition, there were other outbreaks, the number of cases, along with those mentioned above, reaching a total of 1,164, of which 616, or 52·9 per cent., had a fatal termination. As has been said already, the disturbed internal condition of Persia and the interruption of the ordinary channels of communication in all probability prevented information reaching this country; so that the figures given above are not to be taken as representing all the occurrences of cholera that actually took place in Persia during 1917.

III.—A SHORT ACCOUNT

OF THE

REPORTED OCCURRENCES

OF

YELLOW FEVER

throughout the WORLD during 1914, 1915,
1916 and 1917.

CONTENTS.

III. YELLOW FEVER.

PAGE

A.

Ashanti - - - - 274

B.

Bahia - - - - - 256
Barbadoes - - - - 270
Bathurst - - - - 273
Belgian Congo - - - 276
Brazil - - - - - 256

C.

Central America - - - 264
Colombia - - - - 264
Costa Rica - - - - 267
Cuba - - - - - 270
Curação - - - - 269

D.

Dahomey - - - - 274

E.

Ecuador - - - - 262

F.

Freetown - - - - 273
French Guiana - - - 259

G.

Gambia - - - - 273
Gold Coast - - - - 274
Guatemala - - - - 265
Guayaquil - - - - 262

H.

Havana - - - - 270
Honduras - - - - 265

I.

Iquitós - - - - - 261

L.

Lagos - - - - - 275

PAGE.

M.

Manaos - - - - 259
Maranhao - - - - 258
Martinique - - - - 270
Merida - - - - - 268
Mexico - - - - - 267

N.

New Orleans - - - - 273
Nicaragua - - - - 267
Nigeria - - - - 275

P.

Panama - - - - 264
Para - - - - - 258
Pernambuco - - - - 257
Peru - - - - - 261
Petó - - - - - 268
Progresso - - - - 268

R.

Rio de Janeiro - - - 256

S.

San Salvador - - - 267
Sierre Leone - - - - 273

T.

Trinidad - - - - 269

U.

United States - - - 273

V.

Venezuela - - - - 260
Vera Cruz - - - - 267
Victoria - - - - 256

W.

West Indies - - - - 269

Y.

Yucatan - - - - 268

INTRODUCTORY.

The number of outbreaks of yellow fever has greatly diminished during the past four years, and the severity of the disease has been much reduced. The causes which have led to this are various. One is that the existing war conditions have greatly interfered with the movement of travellers or visitors to endemic areas, and the absence of non-immunes has prevented the multiplication of the yellow fever virus. For the development of an outbreak of the disease, three factors are necessary, namely, (1) a supply of the specific virus; (2) a sufficient number of the stegomyia mosquito; and (3) the presence of human susceptible subjects (the so-called non-immunes). A stegomyia once infected retains the capacity of transmitting the infection for the rest of its life. The virus in the blood of a yellow fever patient is only infective to the mosquito during the early days of the illness, so that if an infected generation of the stegomyia dies out before the next generation has had the opportunity of being infected from a human case, the local mosquitoes cease to be able to transmit the disease. It is therefore held that the endemicity of yellow fever is maintained by the arrival of susceptible human subjects, who, when attacked by the illness, afford, at the early stage of the attack, an opportunity for infecting fresh mosquitoes. It is believed by some authorities that one attack of yellow fever usually protects the patient from subsequent attacks, as in small pox or typhus fever. So that the residents in an infected locality cannot, being immune, convey infection to new generations of stegomyia. The war has therefore had a favourable influence in preventing yellow fever by suppressing or at least reducing the number of arrivals of non-immunes in endemic areas, thus interfering with the production of the virus to infect new generations of mosquitoes.* Another factor which has helped to diminish yellow fever generally, has been the eradication of the disease in certain ports, formerly the chief diffusing centres of the infection in the Western hemisphere, notably, Havana, Rio de Janeiro, Vera Cruz, Panama, Para, and Manaos. The eradication has been effected by the application of the measures, largely directed against the stegomyia mosquito, suggested by the United States' Army Yellow Fever Commission, which reported in 1900. These measures have proved very successful, and for some years the disease has been almost entirely absent from the above-mentioned places, save for occasional imported instances; these, however, have led to no extension of the infection. In the subjoined table are given some figures showing the deaths which, year by year, occurred in the above-named places, formerly veritable hot-beds of yellow fever, before the application of the modern scientific methods of eradication were adopted; also, figures showing the incidence of the disease in the years following the application of these measures. For purposes of comparison the deaths from yellow fever are given for a port in which the modern methods have not been introduced, namely, Guayaquil, the chief port of the Republic of Ecuador. Complete death-returns are not available for the same series of years in all instances; but the table suffices to show that, as soon as the measures were introduced, yellow fever practically disappeared, and that at Guayaquil, where nothing was done, the malady persisted. The order in which the new measures were adopted by the various towns was as follows :—(1) Havana in 1900; (2) Vera Cruz in 1903; (3) Panama in 1905; (4) Rio de Janeiro in 1905; (5) Para in 1910; and (6) Manaos in 1912. The practical disappearance of yellow fever from these formerly notorious diffusing centres of infection has undoubtedly led to a very great reduction of yellow fever incidence in most of those parts of South and Central America that formerly suffered much from the malady.

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* *See also* paper read by Assistant Surgeon-General H. R. Carter U.S. Public Health Service, before the Society of Tropical Medicine and Hygiene in June 1917 on the Spontaneous Disappearance of Yellow Fever from the Failure of the Human Host. Also paper on the Spontaneous Elimination of Yellow Fever from Endemic Centres, in the *Annals of Tropical Medicine and Parasitology*, Vol. XIII., No. 4, by the same Author.

TABLE showing the number of Reported Deaths from Yellow Fever in certain places before and after the Inauguration of Modern Methods against the Disease: and giving, for purposes of comparison, the Yellow Fever Deaths recorded in the Port of Guayaquil in which Modern Methods had not been adopted :—

Year.	HAVANA. Estimated Population 300,000.	VERA CRUZ. Estimated Population 45,000.	ISTHMUS OF PANAMA. Estimated Population 400,000.	RIO DE JANEIRO. Estimated Population 1,000,000.	PARA. Estimated Population 200,000.	MANAOS. Estimated Population 60,000.	GUAYAQUIL. Estimated Population 54,500.
1873 -	1,244	—	—	3,659	—	—	—
1874 -	1,425	—	—	828	—	—	—
1875 -	1,101	—	—	1,292	—	—	—
1876 -	1,619	—	—	3,476	—	—	—
1877 -	1,374	—	—	282	—	—	—
1878 -	1,559	—	—	1,176	—	—	—
1879 -	1,444	—	—	974	—	—	—
1880 -	645	—	—	1,625	—	—	—
1881 -	485	—	11	257	—	—	—
1882 -	729	—	36	89	—	—	—
1883 -	849	—	26	1,608	—	—	—
1884 -	511	—	128	863	—	—	—
1885 -	165	—	199	445	—	—	—
1886 -	167	—	308	1,449	—	—	—
1887 -	532	—	216	137	—	—	—
1888 -	468	—	102	747	—	—	—
1889 -	303	—	15	2,156	—	—	—
1890 -	308	—	1	719	—	—	—
1891 -	356	—	202	4,456	—	—	—

Year.	HAVANA. Estimated Population 300,000.	VERA CRUZ. Estimated Population 45,000	ISTHMUS OF PANAMA. Estimated Population 400,000.	RIO DE JANEIRO. Estimated Population 1,000,000.	PARA. Estimated Population 200,000.	MANAOS. Estimated Population 60,000.	GUAYAQUIL. Estimated Population 54,500.
1892 -	357	—	51	4,312	—	—	—
1893 -	496	131	8	825	—	—	—
1894 -	382	209	29	852	—	—	—
1895 -	553	142	*	818		—	—
1896 -	1,282	*	*	2,929		—	—
1897 -	858	*	*	159		—	—
1898 -	136	*	*	1,078		—	—
1899 -	103	127	*	731		—	—
1900 -	310†	594	15	344		—	—
1901 -	18	261	2	299	—	—	—
1902 -	—	103	22	984		—	—
1903 -	—	285	46	584		85	
1904 -	—	375†	5	48	98	56	
1905 -	22	12	62†	289†	183	157	116
1906 -	12	23	1‡	49	149	117	275
1907 -	5	12		39	166	170	120
1908 -	1	1		1	213	117	103
1909 -	—	20	1‡		140	61	228
1910 -		3	2‡		358†	173	113
1911 -	—	—	—	2‡	49	210	102
1912 -	—	—	2‡	3‡	3	96†	166
1913 -	—	—	—	3‡	4	39	123
1914 -				1‡	—		21
1915 -	—	—	2‡	—		—	144
1916 -	—			—		—	152
1917 -	—	—		—	—	—	65

* Number not ascertained.

† The line marks the year when the campaign against the stegomyia, and other measures, were inaugurated.

‡ Imported instances.

A third factor which has had some influence in reducing the spread of yellow fever has been the substitution of steamships for the old sailing vessels. The latter were credited with a large share at one time in conveying the infection from one port to another, even for very long distances across the seas. The conditions on these sailing vessels were favourable to the stegomyia mosquito, and breeding places for it on board were not difficult to find. But on an ocean steamer it is otherwise. The stegomyia is a somewhat delicate insect, avoiding currents of air, and unable very well to stand lowering of temperature below 65° F. Free ventilation on a steamer with a lowered temperature results in the disappearance of this mosquito from the steamer. Modern ocean-going vessels generally carry condensing apparatus to supply water to those on board, so that storage of water in barrels or other receptacles is not needed; consequently breeding places are not easily found by the stegomyia on such ships. The evidence as regards the conveyance of yellow fever infection by steamships was carefully considered by the Paris International Sanitary Conference of 1911–12, and it was distinctly stated by that body that "*there was not a single instance on record where yellow fever had been conveyed overseas, after a long voyage, on a steam vessel to another country unless an actual human case, or cases, of the disease had previously occurred during the voyage.*" The fears, therefore, expressed by some authorities that steamships crossing the ocean might carry infected mosquitoes and introduce yellow fever into a distant country have no substantial grounds, unless, indeed, someone on board has been attacked on the voyage.

During the year 1914 the Panama Ship Canal was opened for traffic. Some experts prior to this formed the opinion that the linking up of the Atlantic and Pacific Oceans by this new waterway might facilitate the spread of yellow fever. But the experience of the four years that have elapsed since the opening of the canal, proves conclusively that these fears were groundless. Yellow fever having been eradicated in the Panama Canal zone, there is no danger of infection being acquired from it when a ship is passing through from one ocean to the other. If a vessel from one of the infected ports of the north-west coast of South America came eastwards through the canal, it would be subjected by the canal authorities to careful medical inspection and other measures, and then dealt with if found infected, so that there is little chance arising of a ship conveying yellow fever through the canal. The fear was also expressed that the increase in trade between America and Asia following upon the construction of the Isthmian Canal would lead to the importation of yellow fever infection from South and Central American ports into Japan, China, India, Australia, and other countries where stegomyiæ abound. This alarm led to some States in Asia adopting regulations contrary to the principles agreed upon at the last Paris International Conference. As regards India, the danger is shown to be but slight; for the distance across the Pacific from South or Central America to Calcutta, the nearest Indian port, is over 11,000 miles; and it is most unlikely that the stegomyiæ could survive so long an ocean voyage. Although there has been communication mostly by the dangerous wooden sailing ships in the past for a very long series of years, between American and Asia, yellow fever, even in its worst days, has never been carried to India. As has been shown the danger, if it ever existed, has now become almost nil in consequence of the rapid disappearance of the disease from many of the areas in South and Central America in which it was formerly endemic and from which it was wont to spread to other countries by the agency of shipping.

The specific parasite of yellow fever has not yet been isolated, though many organisms, one after the other, have been put forward by their discoverers as the cause of the disease. The latest of these claims was made in 1909 by Dr. Harald Seidelin, formerly Professor of Pathology in the University of Merida (Mexico), who found certain bodies in the blood and tissues of yellow fever patients, and these he claimed to be the specific parasites of the disease, giving them the name of *paraplasma flavigenum*. Some other observers also found these bodies in the blood of yellow fever patients; it was therefore hoped that, at last, the true organism of the disease had been discovered. In 1913 the Colonial Office appointed a Commission of four well-known medical experts to study yellow fever in its minor manifestations in West Africa, one of the two recognised endemic regions of the disease. This Commission reported in 1914 that yellow fever had been occurring in West Africa for the past 140 years, but no evidence had been found that the infection had ever been introduced from places outside Africa. In a subsequent report, issued in 1916, the Commission dealt with the claims of Dr. Seidelin that the *paraplasma flavigenum* was the specific parasite of yellow fever. They reported that, after careful investigation and experiments, performed by their scientific experts, and after consideration of all the available evidence, they rejected the claims of Dr. Seidelin. Their conclusions were as follows:—(1) No proof has been given that the bodies named *paraplasma flavigenum* are of a protozoal nature; (2) under that name a number of microscopic objects are included; (3) excluding artefacts, the origin of most of these objects is at present uncertain and, so far, none have proved to possess definite physiological or pathological importance; (4) there is, so far, no reason to regard any of these objects as the cause of yellow fever; and (5) the nature of the virus of yellow fever still remains undetermined.*

Yellow fever has but a limited distribution throughout the world, being confined mostly to two main regions, namely, (1) part of South and Central America and (2) part of the West Coast of Africa. In comparison with the two other principal exotic diseases, plague and cholera, or even with smallpox and typhus fever, the manifestations of yellow fever in recent years might be regarded as almost trivial. The marked decrease in its incidence of late years, as has been pointed out above, affords reasonable grounds for thinking that yellow fever may now be included in the list of diseases that are disappearing from the earth as a result of medical science and the advance of civilisation.

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* Since this was written Professor Noguchi, a Japanese member of the Rockefeller Commission on Yellow Fever, which has been making investigations at Guayaquil, claims to have discovered an organism which is the cause of the disease; he classes it as a parasite intermediate between protozoa and bacilli, and which he calls "leptospira icteroides." He obtained pure cultures of the organism in suitable media, employing a process devised by himself. From the parasite he has prepared a vaccine with which he hopes to immunise persons against yellow fever.

The reported occurrences of the disease during the past four years are described briefly in the following pages.

SOUTH AMERICA.

Brazil.

Rio de Janeiro, as has already been stated, had been for many years one of the chief centres for the diffusion of yellow fever in South America, and the figures given in the table on page 252 show the severe outbreaks that occurred there. In 1905 the preventive measures, based on the findings of the United States' Army Commission of 1900, were initiated with strikingly successful results as will be seen by reference to the table just mentioned. From 1850 to 1905 not far off 60,000 persons died of yellow fever in Rio de Janeiro. In the 10 years previous to the anti-stegomyia campaign, namely, from 1896 to 1905, 7,454 deaths from yellow fever, or an annual average of 745 fatal cases, had been recorded in Rio de Janeiro; but in the 10 years after the campaign had been begun, *i.e.*, from 1906 to 1915, only 101 deaths from the disease occurred in the city; 88 of them occurring during the two years, 1906–07, when the full effects of the measures had not been fully established. In the five years 1909 to 1913, eight fatal cases were certified. All the recent cases have been imported instances.

In 1914, only a single death from yellow fever was reported in Rio de Janeiro, the patient being a Portuguese subject who had arrived on 19th December from Bahia on the s.s. "Vestris." He had stayed three days at the latter port, in which, at the time, yellow fever was prevalent. There can be no doubt that his infection was contracted at Bahia. So far as can be ascertained, there were no deaths from yellow fever in Rio de Janeiro in 1915, 1916, or 1917. The population of this city was estimated in 1912 at about a million.

Victoria is a seaport town of Brazil and the capital of the maritime province of Espiritu Santo, adjoining the province of Rio de Janeiro. The town is situated on an island in Espiritu Santo Bay, and has a population of some 12,000. In January 1917 the British Vice-Consul at Victoria reported an outbreak of yellow fever, and, up to the middle of March, 53 cases had come under observation, with 20 deaths; but no further details of the outbreak or of its source of origin have as yet come to hand.

Bahia, or San Salvador de Bahia, is a seaport town with a population of about 286,000, and is the capital of the province of the same name, situated on the East Coast of Brazil, some 800 miles north of Rio de Janeiro. The reports from this town are somewhat meagre, but it is known that yellow fever has been occurring there with regularity for some years. The sanitary circumstances of the place have been unsatisfactory, and though, of late, efforts have been made to effect improvements, comparatively little has been done to remove the special local conditions which favour the spread of yellow fever. During 1914, 89 persons are stated to have been attacked by the disease, of whom 69, or 77 per cent., died. During 1915, up to July, four cases were reported, with two deaths. So far as can be ascertained there was no yellow fever in Bahia during 1916 and 1917. Attempts in recent years have been made to introduce a main drainage scheme, and a piped water supply; but financial difficulties and the failure of the contractors, who had obtained a concession from the authorities to carry out the work, have hindered the schemes. In the following table are given the number of reported yellow fever cases and deaths in Bahia from 1908 onwards:—

Year.	Cases.	Deaths.
1908	26	14
1909	237	97
1910	18	14
1911	5	5
1912	8	8
1913	78	54
1914	89	69
1915	4	2
1916	—	—
1917	—	—
Total in 10 years	465	263

Calculated on these figures the case mortality-rate for the 10 years' period was 56·5 per cent. But these figures are probably incomplete, and it is possible that they understate the amount of yellow fever that has occurred in Bahia since 1908. The town contains a considerable coloured population, the habits and manner of living of which render sanitary supervision extremely difficult.

Pernambuco, or Recife, is one of the chief ports of Northern Brazil, and has a population of about 230,000. For some years yellow fever has been occurring in the town, though not in epidemic form. Some efforts have been made more recently to improve the sanitary condition of Pernambuco, but apparently not with sufficient thoroughness to eradicate yellow fever from the town. During 1914, 26 cases were reported, with 18 deaths. So far as can be learned there were no cases in 1915 or 1916, but some isolated instances occurred in April 1917 with a few deaths, but the actual numbers have not been supplied. At least one of the cases was an imported instance from Alagoas, a Brazilian town situated on Lake Manguaba, to the south of

Pernambuco. A drainage scheme for Pernambuco was begun in 1910 and was completed at the end of 1914, and at that time attempts were made to destroy the breeding-places of the stegomyia mosquito. It is, therefore, possible that this may account for the comparative absence of yellow fever from Pernambuco during the last three years. The subjoined table gives the number of reported deaths from the disease from 1908:—

Year.	Deaths.
1908	9
1909	16
1910	45
1911	13
1912	41
1913	3
1914	18
1915	—
1916	—
1917	?
Total	145

Maranhão, or Maranham, sometimes called São Luis de Maranhão, is a port in North Brazil, with a population of some 40,000, situated on an island between the rivers Nearim and Itapicura. Though little official information is available as to the incidence of disease in this town, it is known to suffer at times from outbreaks of yellow fever. In the annual report for 1914 of the British Consul for the Para Consular district, in which Maranhão is situated, it is mentioned that during the year a few cases of yellow fever occurred, but no details were given.

Para, or Belem, is the great commercial emporium of the Amazon River trade, and is situated on the River Para, which flows into the Paranan, an arm of the Amazon. It has a population of about 200,000. For many years this town suffered from the continued ravages of yellow fever, as may be seen on reference to the table on page 253. In 1910, in view of the successful eradication of yellow fever at Rio de Janeiro, the authorities at Para instituted similar measures, and since 1911, except for a few imported cases, the town has been free from yellow fever. The introduction of an efficient drainage scheme has greatly improved the sanitary condition of Para. In the seven years 1904 to 1910 the deaths from yellow fever numbered 1,330, but in the seven years following the institution of anti-stegomyia measures the deaths from the disease amounted to 44, 37 of which occurred in 1911, *i.e.*, before, probably, the full effect of the campaign had been experienced. The seven other deaths (making up the 44) were all imported cases, three in

1912 and four in 1913, none being reported in the four years 1914 to 1917.

Manaos is a Brazilian town with a population now estimated at 70,000, situated in the valley of the River Amazon on the Rio Negro, its principal tributary, not far from its junction with the great river. For 60 years or more yellow fever had never been absent from Manaos. In 1856, when it was a much smaller place, with only 1,300 inhabitants, 850 cases and 142 deaths were recorded from the disease. Newcomers, the so-called non-immunes, were almost certain to suffer shortly after arrival; those people who had been long resident being immune. In 1910, 293 cases (and 173 deaths) were reported; in 1911, 540 (210); and in 1912, 292 (96).* In August 1913 an anti-stegomyia campaign was begun in Manaos under the direction of Dr. Theofilo Torres, on the same lines as had been carried out at Rio de Janeiro. As a result, only 39 fatal cases were recorded during that year. So far as can be ascertained no case came under observation in 1914. The British Consul in his Annual Report for that year, referring to Manaos, states that the measures taken to "stamp out" yellow fever appear to have had very satisfactory results as no cases of the disease had been reported in 1914. No attacks were reported in 1915, 1916, or 1917 so far as can be learned. Reference to the table on page 253 shows that from 1903 to 1912 the deaths from yellow fever totalled 1,242 in the 10 years, or an annual average of 124.

It may be mentioned here that yellow fever is endemic in the valley of the Amazon from Iquitos (in Peru) down to the mouth of the river, a distance of more than 2,300 miles. The native population, however, pays little attention to the malady which, as it tends to carry off newcomers, is frequently alluded to by the natives as the "fiebre patriotica," because "it removes the foreigners and more particularly the gringos." Manaos, although it has successfully got rid of the disease, is still very liable to have the infection re-introduced from other places in the Amazon Valley. Unless similar anti-stegomyia measures are carried out in these other towns on the Amazon and its tributaries, it may be difficult to keep Manaos altogether free from the disease. The yellow fever season in this region is from December to July.†

FRENCH GUIANA.

French Guiana (or Cayenne) is situated on the Atlantic coast of South America, due north of Brazil, and is separated from Dutch Guiana by the Maroni River. In September 1914 yellow fever broke out at St. Jean du Maroni, and up to

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* Another report gives the yellow fever deaths in Manaos for these three years as 206, 278 and 154 respectively.

† "Fiebre Amarilla em Manaos," by Dr. Theofilo Torres, *Brazil Medico* for May and June, 1914.

13th October, 19 cases and 11 deaths had been recorded. No details as to the circumstances under which the disease appeared in this place have been received. St. Jean du Maroni is about 195 kilometres from Cayenne, the capital of the Colony, and is a depot for the reception of convicts for the penal settlement.

VENEZUELA.

Yellow fever is known to have been occurring, though not in great amount, in Venezuela for some time past. In 1911 there were 172 reported cases in Caracas, the capital, with 107 deaths; in 1912 there were 54 cases, of which 27 were fatal; and in 1913, only 13 cases. In 1914 there were 8 cases and 5 deaths, but this is probably below the real number, no official report having been received. In 1914, at La Guayra, the port for Caracas, yellow fever was present, but no details have been published. Some cases, too, occurred at Macuto, which is near La Guayra. In July 1914 an outbreak, comprising 40 cases or more, mostly of a mild type, occurred at Maracaibo, and among those attacked were three Americans from the United States. Maracaibo, with a population of 40,000, is situated in the west of Venezuela, and lies on the western shore of the straits connecting the lake of that name with the Gulf of Maracaibo in the Caribbean Sea. Up to the time of writing no information has come to hand as to the occurrence of yellow fever in this Republic during 1915 or 1916. The Venezuelan authorities are, perhaps, more notorious than any others in any of the South American Republics for concealing the presence of infectious diseases within their borders. So that absence of information cannot be regarded as evidence that yellow fever did not occur in Venezuela during 1915 and 1916.

During 1917 eight cases were reported in July at Coro, a town of about 10,000 inhabitants, 210 miles W.N.W. of Caracas, and near the Golfe de Coro.

Acting Assistant-Surgeon Stewart,* of the U.S.A. Public Health Service, reports his conviction that yellow fever is probably endemic in Venezuela, but that owing to its continued presence in the country the number of non-immune persons is so small that an epidemic is not likely to arise owing to the lack of susceptible material. It is not improbable that in other republics of South America the same conditions exist, the occurrence of any noticeable number of yellow fever cases being dependent, as has been said, upon the introduction of susceptible persons from other countries. On the other hand, a commission sent to Venezuela in 1916 by the Rockefeller Institute, and of which Dr. Juan Guiteras of Havana was a member, reported that yellow fever was not endemic on the Caribbean Coast of Colombia or in Venezuela. In their opinion the " acclimatisation fever," common in natives and foreigners, was formerly believed, wrongly, to be a mild form of yellow fever, and to give immunity against that disease. It was, however, regarded by the commission as being a totally different disease. The question as to whether yellow fever is really endemic in Venezuela cannot yet be regarded as definitely settled. On the available evidence it seems probable that it is endemic, and that evidence of its existence is only found when it attacks a non-immune person recently arrived in the country.

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* *Vide* Annual Report of the Surgeon-General of the U.S.A. Public Health Service for the Fiscal Year 1915–16.

PERU.

The only information received from Peru respecting yellow fever in 1914 came from Iquitos, a town of about 12,754 inhabitants, mostly Indians, in the Department of Loreto, on the left bank of the Maranon, the local name for one of the upper heads of the Amazon. This river, the largest in the world, is navigable for ocean-going steamers from its mouth up to Iquitos.

At the end of November 1914 alarm was locally excited by the occurrence in the town of two cases of yellow fever, one of which proved fatal. No source of infection could be traced in either instance, and no case of the disease had been reported in Iquitos since February 1913, a period of nearly 20 months. No vessel had come from Manaos since early in October, that is, for nearly two months prior to the appearance of the two cases.

Public opinion has usually blamed Manaos for sending yellow fever infection by steamer to Iquitos in the past. This origin of the two cases having been excluded, the opinion was expressed that the disease might have been brought overland from some other quarter, or that the malady might have been previously occurring in a mild or unrecognised form in the town, and that only when the infection reached a non-immune person did the symptoms become typical, leading to the malady being diagnosed as yellow fever.

It is only of late years that the occurrence of yellow fever in Iquitos has been admitted, but, prior to that, an illness was common at times known locally as "*vomito negro*," a term applied elsewhere in South and Central America to yellow fever.

Dr. G. M. Converse,* who investigated the subject, states that "the identity of the two diseases must be taken for granted," but no statistics regarding "*vomito negro*" in this town are at present available.

It may be mentioned that more than half of the total deaths from all causes occurring annually in Iquitos are registered as due to "cause unknown," not having been seen by a medical man before the termination of the illness.

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* *Vide* U.S. Public Health Report, 13th November, 1914.

In 1912, of 273 deaths of persons between 15 and 30 years of age, 119 were certified as having died of yellow fever at Iquitos.

Dr. Converse went there in January 1913 to supervise the carrying out of anti-stegomyia measures, his object being to confine his efforts to destroying the breeding places of the house mosquito.

It is interesting to learn that no fumigations were done to destroy adult stegomyiæ, but only destruction of larvæ and the screening of water-containers. For 18 months after this work was commenced, no yellow fever cases occurred, although in previous years this malady had never failed to be present in more or less epidemic form at some season of the year. Also it was observed that the general mortality-rate fell from 49·52 in 1912 to 28·88 in 1913.

Though no information respecting the occurrence of yellow fever in 1914, 1915, 1916, or 1917 has been received from any other part of the Republic of Peru, this cannot be taken as implying that the disease was absent from the rest of the country during these years. But it is probable that the interference with trade caused by the war and the consequent stoppages of the arrival of non-immunes from other countries, has had effect in a diminished incidence of yellow fever at Peruvian ports, as elsewhere.

ECUADOR.

Yellow fever has been for some time prevalent in Ecuador, especially in Guayaquil, the chief port of the Republic, its population being about 60,000. Guayaquil has long had the sinister reputation of being the chief diffusing centre of yellow fever in South America. Its sanitary condition has been greatly neglected, and all the circumstances of the town have been favourable to the spread of the disease. It is true that the amount of yellow fever in past years was greater than at present, but that deaths from this preventable malady should, in the light of present knowledge, be allowed to continue year after year is a reflection upon the efficiency of the sanitary administration of the town. Some idea of the extent of the annual prevalence of the disease in Guayaquil in past years may be gathered from the following table, which gives the number of cases of yellow fever admitted to hospital year by year from 1896 to 1904 :—

Year.	No. of Cases.
1896	670
1897	3,575
1898	2,527
1899	2,750
1900	3,361
1901	2,946

Year.		No. of Cases.
1902	- - - - - - -	1,023
1903	- - - - - - -	3,232
1904	- - - (3 months only)	840
	Total in 8¼ years - - -	20,924*

Unfortunately the number of cases isolated in hospital in more recent years is not available, so that the recorded yellow fever deaths must be taken as the index of the prevalence of the disease in Guayaquil from 1905 to 1917. These figures are given in the table on page 253, and need not therefore be repeated here. During 1914, so far as can be ascertained, only 42 cases of yellow fever occurred in Guayaquil, with 21 deaths, as compared with 342 cases and 186 deaths in the previous year. It is not certain that the figures given above for 1914 represent all the incidence of the disease in Guayaquil during the year. The records received for 1915 are incomplete, and those coming from one source are different from those received from another. One account gives 144 yellow fever deaths in 1915, while another, admittedly incomplete, gives only 12. In 1916 yellow fever was again epidemic in Guayaquil, giving rise, it is stated, to 261 cases and 152 deaths. That the reporting of yellow fever is defective in Ecuador is well known; but an official report by Dr. Becerra, Director-General of Sanitation for the Republic of Ecuador for 1915–16, states definitely that yellow fever caused 682 deaths during that period. So that probably the number of deaths from that disease in Guayaquil given above, for 1915, is probably below the mark. During 1917 yellow fever seems to have decreased somewhat in Guayaquil. According to the information received to date, there were 146 cases and 65 deaths.

During 1916 a special medical commission of American experts, under the leadership of Surgeon-General Gorgas, visited Guayaquil to study the best methods for eradicating yellow fever. Prior to this, however, the Government of the United States had agreed to assist the authorities in providing a sewerage scheme and a piped water-supply for the city, and also proper paving of the streets as well as other sanitary improvements. How far these works have been carried out there is no information to show.

Among other places in which yellow fever appeared in Ecuador during 1914 may be mentioned the town of Esmereldas, the capital of a province of the same name, situated in the north of the Republic and having a population of 3,000. It appears that the disease became prevalent in April among some troops that had come from the interior. These troops seem to have consisted largely of non-immunes, and it was therefore found necessary to replace them by coast battalions which had become immune to yellow fever. Some cases also were reported during 1914 at Milagro and Naranjito, the latter being situated about 30 kilometres from Guayaquil. Yellow fever had occurred in 1913 both in Milagro and Naranjito. In 1915 the occurrence of yellow fever seems to have been confined to Guayaquil, but in 1916 Milagro and Naranjito again suffered, as also Bobahoyo, Duran, and Chobo. In 1917 Milagro, Naranjito, Bobahoyo, and Chobo again suffered, and the disease appeared sporadically at Yaguachi, 25 kilometres from Guayaquil. It is more than probable that the source of infection for all of the above-mentioned places was Guayaquil. In an article entitled "Recentes Observaciones sobre le Fiebre Amarilla," published in the *Repertorio de Med. y Chirurg.*, Bogota, for March 1917, by Dr. J. Guiteras, Director of Health for Cuba, and an authority on yellow fever, it is observed that "the condition of Guayaquil will remain favourable to yellow fever until energetic measures are taken against the stegomyia fasciata, which, at present, has unbounded opportunities for breeding there."

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* These figures are taken from the U.S.A. Public Health Reports, Vol. I, 1904.

COLOMBIA.

Yellow fever occurs sporadically in the Republic of Colombia, and cases are reported from time to time at Carthagena, one of its principal towns, situated at the mouth of the River Magdalena which flows into the Caribbean Sea. From 1899 to 1910 some 58 cases were reported, or an average of about five annually; but none appear to have been reported during recent years. In October 1915 the United States Consul reported an outbreak of yellow fever at Buenaventura, a small town with 5,000 inhabitants, situated on the Pacific coast of Colombia. No details of the outbreak, however, have been forthcoming, but two persons arrived on shipboard at Balboa quarantine station of the Panama Canal Zone, one in September and one in October, from Buenaventura, suffering from yellow fever, both of whom died. On 15th December, the British representative at Panama reported that two more shipborne cases had been landed there from Buenaventura and had been isolated at the quarantine station.

No reports regarding yellow fever in the Republic of Colombia have been received during 1916 and 1917.

CENTRAL AMERICA.

Panama.

In a previous report* an account was given of the change that had been effected in the Canal Zone by Surgeon-General Gorgas and his staff in the matter of yellow fever prevention, and how, from a notorious diffusing centre of the disease, Panama had been completely free from the infection, save for a few imported cases, from which there had never been any extension. The work was begun in 1905, and since then only eight deaths (all imported instances) have been recorded. Panama, even in the 16th century, was a fatal place to visit, and many Spaniards succumbed to the "jaundiced handmaiden of death" who awaited their arrival in this mosquito-infested "pest-hole of the world."

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* Annual Report of the Board's Medical Officer for 1912–13, Appendix 3, page 158.

As has already been mentioned, four shipborne yellow fever cases, with two deaths, occurred in 1915 at the Balbao quarantine station, the patients having arrived from Buenaventura (in Colombia), where the disease was then prevalent. So far as can be learned there were no cases, imported or otherwise, during 1916 and 1917.

Honduras.

In December 1917 some cases of yellow fever were reported at Tegucigalpa, the capital of the Republic of Honduras, with a population of 23,000. No details of these cases have been received, except that up to January 19th, 1918, two had proved fatal. There is no evidence of recent yellow fever in the Republic of Honduras, and, as Tegucigalpa is an inland town at least 100 kilometres from the coast, the probabilities are that the 1917 cases were due to imported infection.

The last reported serious epidemic of yellow fever in Honduras was in 1905 when 1,096 cases and 326 deaths were recorded. With the exception of sporadic cases in 1906, and an imported instance in the person of a United States sailor in 1911, little has been heard of the disease in recent years until 1917, as stated above.

Guatemala.

Yellow fever is endemic in the low-lying districts of Guatemala situated on the Pacific coast, where numerous salt marshes exist with an abundant supply of the stegomyia mosquito. Under normal conditions the disease attracts little attention locally, as the natives of these low-lying marshy districts appear to be little affected in adult life by the disease, having, it is believed, acquired immunity by mild attacks during their childhood. On the Mexican Pacific coast districts, adjoining Guatemala, a disease is prevalent, from time to time, called by the native Indians "jacatemal," and regarded as identical with yellow fever, since the symptoms are the same. The last serious epidemic of yellow fever in Guatemala was in 1905, when upwards of 1,500 persons were attacked, and of these, about 1,000 died. Sporadic cases were reported in 1906–7, but since then no definite information as to the occurrence of yellow fever in Guatemala has reached this country until quite recently, when, at the end of 1917 and beginning of 1918, the disease began to be prevalent. The conditions were abnormal, for severe earthquakes in 1917 had wrecked the city of Guatemala and many thousands of these inland susceptible people fled from that place, and those adjoining it, to the coastal districts. The recent epidemic began at Ajutla, on the Mexican border, and situated on a sluggish river, and in a generally unhealthy environment. At Ajutla a yearly fair is held, and an annual pilgrimage takes place from Guatemala and parts of Mexico to this place to worship a local image which is held in high regard. In 1917 an exceptionally large number of persons, estimated at between 30,000 and 40,000, attended the fair and pilgrimage, in this insanitary village, and the first yellow fever cases occurred shortly after the fair was closed. It is surmised that persons suffering from "jacatemal" may have brought the yellow fever infection to Ajutla, and the dispersal of the people after the fair carried the disease to other districts in Guatemala. The affected districts were Ajutla, Pajapita, Coatepeque, Retalhulen, and Mazatenango, comprising a combined area of from 300 to 400 square miles. At the time of writing no information has been available as to the number of cases and deaths of yellow fever in the above-named Guatemalan districts. The epidemic in 1918 lasted from February to July. At first no attention was paid by the authorities to the epidemic, and three months were allowed to pass before any steps were taken to control its spread. But at last a medical board was appointed by the Government and sent to the affected districts to investigate the facts and advise the local authorities. The measures taken appear to have met with some success, and the reports issued in July stated that the Rockefeller Institute were sending a yellow fever unit from the United States to the infected area. The course of this outbreak therefore began by the introduction of the disease into the annual fair at Ajutla; the infection was then carried by the dispersing people after the fair to other districts, where ample susceptible material was present in the persons of the numerous refugees from Guatemala city and other inland towns temporarily residing in the coastal districts. It is stated that the incompetence of the native medical practitioners contributed to the development of the epidemic, which, however, appears to have been generally of a mild type. Yellow fever, it may be mentioned, was present in the adjoining Republic of Honduras in December 1917, and it is probable that both it and Guatemala owed their infection by yellow fever to the same source.

During 1918 the presence of yellow fever was reported at San Jose and Escuintla, both situated in the Department of Escuintla, the former place being on the Pacific coast and the latter a few miles inland, and on the railway from the coast to the interior. As yet the details of these outbreaks have not been received.

Other Central American Republics.

No reports have been received as to the occurrence of yellow fever in Costa Rica, Nicaragua, or San Salvador during the last four years. The disease has been reported in these States in former years, but at no time is it easy to learn what is going on in them as regards epidemic diseases. So that it can hardly be concluded that the absence of information is any proof that yellow fever has not occurred during 1914, 1915, 1916, or 1917. The last that was heard of the presence of the disease in Costa Rica was in 1908, in Nicaragua in 1905 and in San Salvador in 1907.

MEXICO.

Owing to the disturbed and unsettled state of the country very little direct information has been available respecting the incidence of yellow fever in Mexico from 1914 to 1917. What reports have come to hand have been mainly from the United States. During 1914 some cases occurred in the peninsula of Yucatan, among other places at Progresso, 25 miles from Merida, and the chief port of that region. In this connection it may be mentioned that in November two patients were landed from a ship at the Havana quarantine station, Cuba, suffering from yellow fever contracted at Progresso. Some cases also occurred at Campeachy, another Mexican seaport town situated on the western side of the Yucatan peninsula. Reference to the incidence of yellow fever in Mexico in 1914 was made by Dr. E. Liceaga in the *American Journal of Tropical Diseases* for August 1914. In this he describes what had been done to combat the stegomyia mosquito in Yucatan. Dr. Liceaga maintains that yellow fever has been endemic on the east coast of Mexico for 400 years. On the west or Pacific coast of the Republic the disease has occurred in epidemic form from time to time, but these outbreaks have been due to imported infection. For this reason the principal routine measures against yellow fever have been applied at the seaports situated in the Gulf of Mexico.

During May 1915 a rumour was current that yellow fever was prevalent at Vera Cruz, the principal port of Mexico, on the east coast, population 45,000. But although the rumour was repeated in Consular reports, an official statement was made later by one of the Consuls to the effect that "the report respecting the occurrence of yellow fever at Vera Cruz had been based on inaccurate information." In November 1915 the British Ambassador at Madrid announced the occurrence of yellow fever at Vera Cruz, and in the same month Cuba declared quarantine against arrivals from that port. No information from other sources has been received confirming the report as to the occurrence of yellow fever cases at Vera Cruz in November 1915; if correct they were probably imported instances, as this port is one of the places in which, by the application of modern scientific measures, yellow fever has been eradicated completely. A reference to the table on page 253 will show the change that has taken place in Vera Cruz since 1903, when the anti-stegomyia campaign was commenced. From its position and its large shipping trade this port is liable to have yellow fever brought to it on shipboard from all the infected ports in the Gulf of Mexico.

During the early part of 1915, cases of a mild type were observed at Merida, 25 miles from the coast, the capital of the province of Yucatan, and having a population of about 62,000. So far as is known, only two of the cases proved fatal.

In 1916 an outbreak was again reported at Merida comprising, between 1st July and 18th October, some 30 cases, with nine deaths. At Progresso, which is the port for Merida, three cases and one death were reported. Also a single fatal case at Frontera, a port in the Gulf of Mexico between Vera Cruz and Campeachy, in the province of Tabasco. The presence of yellow fever was reported in September at Tuxpan, 250 kilometres north of Vera Cruz, and at Campeachy in October.

During June 1917 yellow fever appeared at Petó (Yucatan), the inland terminus of a railway which runs to Progresso on the coast, passing through Merida. About seven cases were reported, with three deaths. About the same time six cases and two deaths occurred at Merida, and also two cases at Campeachy in August. There is a railway connection between Campeachy and Merida. Those attacked at Petó were soldiers, "non-immunes," who had come from the interior of Mexico.

In 1916 a report on yellow fever was published in the *Boletin del Consejo Superior de Salubridad* (No. 10, 1916) by Dr. A. E. Gochicoa, of the Superior Council of Health for Mexico. In this it was stated that yellow fever is endemic in the peninsula of Yucatan and that Merida is one of the principal foci. The occurrence of the disease became noticeable mostly after the arrival of strangers (non-immunes). There was a great abundance of the stegomyia mosquito in the peninsula, and unfortunately a conspicuous absence of sustained effort to reduce the number of these insects. Dr. Gochicoa referred to the three factors required for the transmission of the yellow fever infection, namely: (1) a person, or persons, suffering from the disease; (2) the presence of stegomyiæ; and (3) the arrival of non-immunes or susceptible subjects. The three main factors concerned in preventing the spread of the infection were also recalled, namely: (1) the isolation of the sick; (2) the destruction of the stegomyiæ; and (3) the protection of non-immunes from the bites of these insects. As it was impossible in Yucatan to discover, on all occasions, persons suffering from mild attacks of yellow fever, especially in children or among natives, it was impossible to isolate at once all those who were attacked by yellow fever, or to prevent them from being bitten by the mosquitoes, or to protect non-immunes from the bites of these insects. In the circumstances, Dr. Gochicoa considered that it was essential that steps should be taken to destroy the stegomyiæ and their larvæ, and to eradicate their breeding places. He added in conclusion that, if the exploitation of the resources of the Yucatan peninsula was to be carried out by imported labour, the first and most necessary step to be taken was an energetic and sustained campaign against these insect-transmitters of the yellow fever infection.

It is reported by the officers of the U.S.A. Public Health Service stationed at Mexican ports that in some localities fatal cases of illness occur having a striking resemblance to yellow fever, but diagnosed by the local authorities as "icteria," "malaria," or "gastro-enteritis." It is suggested that these may be instances of yellow fever; and as none of the usual precautions against the disease have been taken the spread of the infection to persons newly arrived in the locality, and therefore susceptible, would be almost inevitable. Owing to war conditions the number of non-immunes or susceptibles arriving in Mexican ports has for the time been greatly reduced.

THE WEST INDIES.

The West Indies were at one time, and not so long ago, regarded as essentially the home of yellow fever. The disease formerly caused great mortality among the troops garrisoning the islands and among the crews of ships engaged in West Indian waters. Of late years the malady has practically disappeared from most of these islands.

CURAÇÃO.

Curação, with a population of 33,000, is the most important of the Dutch West Indian Islands and lies about 40 miles off the coast of Venezuela. In December 1914 a single case of yellow fever, which had a fatal termination, was reported at Curação, but no information has been given as to its probable origin. It is possible that the infection may have come from Venezuela, in which, at the time, the disease was known to be present.

In January 1915, the Cuban Government imposed quarantine restrictions on all arrivals from Curação. Since then no cases appear to have been reported, but the quarantine measures were not removed by Cuba until 2nd March 1916.

TRINIDAD.

In March 1914 two cases of yellow fever came under observation in the island of Trinidad, one at Labrea and the other at Brighton, some 40 miles from Port-of-Spain.

It may be remembered that, at the end of 1913, an outbreak comprising 10 cases had occurred at Brighton; it is therefore probable that the above two cases reported in 1914 were connected with the 1913 infection. There were no reported cases in the island of Trinidad during 1915, 1916, or 1917.

BARBADOES.

Barbadoes, one of the Windward Islands, is the most easterly of the West Indies and has a population of about 172,000. In September 1916 suspected cases of yellow fever were reported, and up to December about 20 cases, with 8 deaths, came under observation. Post-mortem examination of two fatal cases at the beginning of the outbreak gave what were regarded as the characteristic appearances of yellow fever. On 14th December—that is about 2½ months after the last fatal case was recorded—Dr. Juan Guiteras, Director of Public Health in Cuba and a yellow fever expert, visited Barbadoes. After investigation, he stated his definite opinion that the outbreak had not been one of true yellow fever, and that the recent prevalence had been one of " a form of jaundice."

MARTINIQUE.

In November 1916 a fatal case of yellow fever was reported at Fort-de-France, population 27,000, the capital of Martinique, one of the Lesser Antilles. No details, however, have been received as to the origin of this case. It has been stated that for a long time yellow fever was endemic in Martinique, and there was, according to Clemow, a marked prevalence of the disease there from 1895 to 1898. From 1907 to 1909 there was an epidemic of yellow fever in Martinique, beginning at Fort-de-France; it was particularly mild among the native population and especially among children, among whom some 900 suspected cases were observed. Most of the fatal cases at first were among Europeans, of whom 100 were attacked and 19 died. The undoubted cases were said to number 206, with 30 deaths, but the suspected cases amounted to 1,028, of whom 18 died. MM. Simond, Aubert, and Noc,* who reported on this epidemic, expressed the opinion that the frequent cases of "fièvre inflammatoire," commonly seen in Martinique, were really a mild manifestation of yellow fever infection. Severe attacks were most frequently seen among strangers who had recently arrived in the island.

CUBA.

For many years yellow fever committed great ravages in Cuba and especially among the population of Havana, which was formerly characterised as being a hotbed of the infection. From 1853 to 1900, 35,952 deaths were recorded from the malady in that town. The preventive measures, based upon the conclusions arrived at by the Commission of Experts appointed in 1900 by the United States Government, were begun in 1901, from which time yellow fever has practically disappeared from Havana, only imported cases from ships being reported now and again, but from which no spread of infection has occurred.

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* *Vide Annales d'Hygiène et de Médecine Coloniales*, No. 4, 1909.

During 1914 two passengers were landed from the s.s. "Esperanza" which had arrived at Havana from the Mexican port of Progresso. In the previous year also, two cases had been landed at Havana from ships, one of which had come from the port of Progresso. Prior to 1913 no certified case of yellow fever had occurred in Havana since 1908.

During 1915 there appear to have been no reported cases of yellow fever in Havana, nor in 1916 or 1917.

The incidence of fatal yellow fever in the city of Havana during the last 64 years may be seen in the following table, which has been taken from a report read before the Second Pan-American Scientific Congress, held in Washington, D.C., at the end of 1915 and beginning of 1916, by Dr. Juan Guiteras, Director of Health of Cuba, and Professor of General Pathology and Tropical Diseases in the University of Havana.

In examining the table it has to be remembered, as already stated, that the anti-stegomyia measures, based on the results of the work of the American Yellow Fever Commission, were begun in Havana in 1901. Havana, therefore, was the first place in which yellow fever was eradicated by the adoption of the modern methods indicated by the above-mentioned Commission as a result of their investigations and experiments.

DEATHS FROM YELLOW FEVER IN HAVANA FROM 1854 TO 1917.

Year.	Deaths from Yellow Fever.	Death-rate from Yellow Fever per 10,000 of Population.
1854	1,042	49·18
1855	669	31·72
1856	1,308	62·31
1857	2,058	98·38
1858	1,396	67·01
1859	1,193	57·51
1860	439	21·25
1861	1,020	49·59
1862	1,336	67·53
1863	550	26·85
1864	555	27·15
1865	238	11·67
1866	51	2·50
1867	591	29·10
1868	290	14·31
1869	1,000	49·45
1870	572	28·34
1871	991	49·22
1872	515	25·63
1873	1,244	62·05

Year.	Deaths from Yellow Fever.	Death-rate from Yellow Fever per 10,000 of Population.
1874 - - -	1,425	71·24
1875 - - -	1,101	50·15
1876 - - -	1,619	81·29
1877 - - -	1,374	69·14
1878 - - -	1,559	78·38
1879 - - -	1,444	72·55
1880 - - -	645	32·38
1881 - - -	485	24·32
1882 - - -	729	36·54
1883 - - -	849	42·52
1884 - - -	511	25·57
1885 - - -	165	8·25
1886 - - -	167	8·34
1887 - - -	532	26·56
1888 - - -	468	23·34
1889 - - -	303	14·83
1890 - - -	308	14·80
1891 - - -	356	16·80
1892 - - -	357	16·56
1893 - - -	496	22·61
1894 - - -	382	17·11
1895 - - -	553	24·36
1896 - - -	1,282	55·56
1897 - - -	858	36·59
1898 - - -	136	5·70
1899 - - -	103	4·25
1900 - - -	310	12·41
1901 - - -	18*	0·69
1902 - - -	—	—
1903 - - -	—	—
1904 - - -	—	—
1905 - - -	22	0·76
1906 - - -	12	0·40
1907 - - -	5	0·16
1908 - - -	1	0·03
1909 - - -	—	—
1910 - - -	—	—
1911 - - -	—	—
1912 - - -	—	—
1913 - - -	—	—
1914 - - -	—	—
1915 - - -	—	—
1916 - - -	—	—
1917 - - -	—	—

The population of Havana in 1911 was estimated at 300,000.

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* The Anti-Stegomyia measures were begun in 1901 at Havana.

THE UNITED STATES.

In August 1916 the Danish steamer "Borghese," from Progresso (Mexico), landed two cases of yellow fever at the quarantine station of New Orleans. The voyage from Progresso, in which, and in the vicinity, yellow fever had been appearing from July to October 1916, occupied only three days. There were no subsequent cases in 1916 or in 1917 at New Orleans, which town has remained free from the disease for a series of years, save for occasional imported instances like the above.

WEST AFRICA.

The Gambia.

In November 1914 a report was received stating that a trained nurse had been attacked by yellow fever at Bathurst, the capital of the Gambia Colony. In December, however, the Colonial Office was informed that the medical man in attendance on the case had now, upon further consideration, come to the conclusion that the illness after all had not been true yellow fever.

In 1913 there had been 13 cases of this disease, with 10 deaths in the Gambia, and 12 of these attacks were referred to Bathurst.

No cases were reported during 1915, but in March 1916 a single fatal instance diagnosed as yellow fever in a native from Jenkundu, in North Bank Province, occurred at Bathurst; this was obviously an imported case. So far as can be learned, there was no reported yellow fever in the Gambia during 1917.

Sierra Leone.

A single case of yellow fever in the person of a European official occurred during 1914 at Boia, about 60 miles from Freetown, in the British Colony of Sierre Leone. The patient recovered, and so far as can be learned there were no subsequent cases during the year.

There had been an outbreak of the disease in 1910, comprising 21 cases and 16 deaths, in Freetown, the capital of the Colony, and some other cases also occurred in that town during 1911.

About that time suggestion was made by some medical officers serving in the Colony that yellow fever under some other name was not infrequently met with amongst the native population in various localities.

In 1915 no cases were reported, but in 1916 a European from Blama, which is situated 150 miles from Sierra Leone, was attacked by yellow fever at Freetown in December. There were no reported cases in 1917.

The town of Freetown has now a piped water-supply, and since this was provided, the stegomyia index has been reduced to a low figure, though much still remains to be done to remove the conditions which foster the breeding of mosquitoes of one or another sort in this town.

The Gold Coast Colony.

Yellow fever was present in the Gold Coast Colony from 1910 to 1913, and the disease reappeared there early in 1914.

This British Colony has a coast-line of 350 miles and lies between German Togoland on the east and the French Ivory coast on the west. It now comprises also Ashanti and the Northern Territories. Including these dependencies, the Colony had in 1911 a population of 1,503,386.

The yellow fever cases in the Gold Coast during 1914 were scattered over a number of places, including Saltpond, Accra, Quittah (or Kaitta), Somanya, and Axim; the attacks amounted to 19, of which 9 had a fatal termination; 9 of the cases and 4 of the deaths were Europeans, while 10 of the attacks were in natives, of whom 5 died.

In Ashanti there were four cases and two deaths, three of the former and one of the latter occurring at Ayinam near Obuasi, about 95 miles from the coast.

In the Northern Territories, six cases and two deaths came under observation, five of the attacks and one death being referred to Tamale and one case to Bole.

It appears from a report* on yellow fever investigation work, carried out in the Gold Coast Colony and the Northern Territories, that a disease resembling yellow fever is known to exist among the natives in certain districts under several names, such as the "bad sickness" or "the black vomit," &c., &c., terms suggestive of yellow fever.

In December 1915 a European died of yellow fever at Accra, and in March and April 1916 four cases were reported at Nsawam, which lies inland about 27 miles from the coast; three of those attacked were Europeans, of whom two died, the remaining case being a native who also succumbed to his attack. In April 1916 two cases of yellow fever occurred at Lome, formerly the capital of German Togoland, and close to the borders of the Gold Coast Colony. During July 1916 a native died of the disease at Secondee, and in November a European also lost his life from an attack at Gumbaga in the Northern Territories. Two imported cases occurred at Accra, the capital of the Gold Coast Colony, in July 1917. Both of the patients were Europeans who had contracted their illness at Ningo, which is about 30 miles from Accra.

Dahomey.

In March 1917 a single case of yellow fever was reported at Porto Novo, a trading station in the French Colony of Dahomey; but no particulars as to the origin of the illness have as yet been furnished.

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* By Dr. H. Sinclair Coghill and Dr. H. M. Hanschell, published in Supplement Volume II., issued by the Yellow Fever Commission (West Africa), 18th August, 1915.

Nigeria.

In May 1913 an outbreak of yellow fever had occurred at Lagos, and cases were reported up to the end of the year, numbering altogether 38, of which 10 had a fatal termination; 20 of the cases were negroes, in whom the attacks were mild, none of them ending in death; 15 were Europeans and 3 were Syrians. Of these last 18 cases in non-immunes, 10, or 55 per cent., died. All of the yellow fever cases at Lagos occurred in persons belonging to the mercantile, trading, and seafaring communities, which of necessity are brought daily into close contact with the native population. Moreover, the trading classes have their quarters nearer the native element, and they are well known to be careless in the use of anti-mosquito nets.

During the early part of 1914 other cases occurred in Lagos, a continuation, no doubt, of the prevalence of the previous year. One of the cases was reported in February on a vessel, the s.s. "Portonovo," from Forcados. Other cases were recorded at Koko in January on the s.s. "Arnfried," on which, within a few hours, five men (two firemen, two engineers, and the boatswain) fell ill; one of these cases was diagnosed readily as yellow fever, two were regarded as suspicious of yellow fever, and two were believed to be malaria.

In this connection it may be mentioned that the conjunction of yellow fever and malaria in the same subject is stated by some authorities to be possible. This vessel had been on a trip which involved calls at Lagos, Forcados, Warri, and Sapele, at all of which yellow fever had been present in 1913.

Cases were reported, too, during 1914, at Onitsha, Zungaru, Calabar (on the s.s. "Yola"), and at Ebute Metta. Two cases occurred also on shipboard at Burutu on the s.s. "Nemba" in March, and the other on the s.s. "Ashanti" in October.

It is believed by some that yellow fever has been occurring in the past on the coast of Nigeria among the natives in an unrecognised and comparatively mild form, and that occasionally cases due to yellow fever infection with more serious symptoms have been looked upon as malignant malaria.

In the milder instances the native patients do not seek medical advice, and they consequently go unreported. It is only when non-immunes, that is, newcomers, are attacked, and with severe and more typical symptoms, that the disease gets recognised as yellow fever, and ultimately reported as such.

Among the natives of Calabar, the Cross River districts, and the oil rivers at Bonny, Degema, and elsewhere, a disease occurs among the natives, in adults as well as in children, characterised by fever, lasting several days and accompanied by jaundice, affecting especially the conjunctivæ, and known locally under the name of "uto-enyen" or yellow eyes; this is believed by some observers to be in reality yellow fever.*

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* Dr. I. M. Russel Leonard's Report on Certain Outbreaks of Yellow Fever in Lagos in 1913 and 1914; *vide* supplement, Volume I., issued by the Yellow Fever Commission (West Africa), 29th May, 1915.

According to the Annual Report for 1914 of the Governor-General of Nigeria, all the cases of yellow fever reported during the year were Europeans, no attacks coming under observation among the native population.

In September 1915 two cases of yellow fever and one death were reported to have occurred at Onitsha, an inland town in the Central Province of Nigeria; and in September a native was attacked also by the disease at Burutu. In October, five more cases of yellow fever, with two deaths, were recorded at a camp in the Engenni Concessions, on the Engenni River, 20 miles from Degema. Another fatal attack in a native was reported in November at Akassa, which, like Burutu, is on the coast.

During December 1916 a fatal case of yellow fever in a European, the purser of the s.s. "Palma," occurred on board this vessel when lying in Lagos Roads. The man was ill when the "Palma" arrived at Lagos from a coasting trip. The diagnosis was confirmed by a post-mortem examination. The patient was too ill when first seen to permit of removal to hospital, and he died on board the ship.

In May 1917 a single fatal yellow fever case was reported at Lagos, and in October several cases occurred at Benoue (or Benuë), in Northern Nigeria, and in the same month several other cases, the number of which has not been stated, were reported in Southern Nigeria at Forcados. No details of these outbreaks have, however, been received.

THE BELGIAN CONGO STATE.

In October 1917 the British Acting Consul at Boma reported the occurrence of yellow fever at Matadi, a town with 8,000 inhabitants, situated at the head of the navigable part of the Congo, about 100 miles from the mouth of the river, and the starting place of the railway to Leopoldville. Three deaths were recorded from October to November, but details as to the number of cases and the source whence the infection came have not yet been published.

NOTE.

It is worth mentioning that the International Health Board constituted by the Rockefeller Foundation (which has given valuable assistance recently to places in South and Central America where yellow fever has occurred), in its report for 1917 states: "Since Reed's discovery that yellow fever is conveyed by the stegomyia mosquito (now known as Ædes calopus), the complete eradication of the disease has become largely a matter of local sanitation. Sanitarians are agreed that to accomplish this result it is necessary only to control the breeding places of mosquitoes in the endemic centres of the infection."*

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* The Rockefeller Foundation, International Health Board, Fourth Annual Report, January to December, 1917.

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